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THE GENERAL ELECTRIC REPORT.

Elsewhere in this issue is given an abstract of the annual report of the General Electric Company for 1908-9. Always a document of great importance, the report this year has a special value as showing how far the depression in business affected electrical industries broadly, by placing in comparison with the figures of the boom period of 1906-7-8 those following the collapse. It appears that the orders received by the company in 1908 were only 70 per cent in value of those for each of the two preceding years and the shipments were only 60 per cent. To take the exact figures, the sales billed in 1908-9 were only $44,540,676, while in 1907-8 they were no less than $70,977,168 and in 1907 they were $60,071,883. These are indeed sharp declines, but it appears that 1908-9 was after all the best year if we leave out the tremendously active boom epoch, with its dangerous extremes of high prices and low profits. As a matter of fact, the General Electric Company with its smaller business and lower prices last year came very nearly meeting its dividends out of regular profits and made but a slight charge on surplus, which to-day is over $16,000,000, while the company is carrying a large cash balance that it hopes now, says President Coffin, "will be profitably used." There is no reason in sight why next year should not see any and all of the peaks of the past overtopped, yet on a more stable basis of prosperity because of the increase in population and wealth and the growing use of electrical energy and apparatus.

The engineering report of Vice-President Rice is quite encouraging in its references to new work, larger types, forward lines of experiment and a widened contact with general industry. He notes the 10,000-hp induction motors for Gary, the 12 new locomotives for the New York Central, the 14,000-kw turbines for Chicago, the new vertical rotaries of 2500 kw, all evidences of the truth that dull and depressed times are not without their stimulus and often come as a blessing in disguise. The only use of standards in electricity is as points of new departure; and here is every evidence that this great typical electrical enterprise is progressive and ever alert to newer opportunities of development.

THE IOWA CONVENTION.

The Iowa Electrical Association last week held another of its notably successful annual conventions. The success of this association lies in the well-balanced character of its programs, which are confined to subjects of immediate interest to the large number of small companies of which the association is composed. Exhibits are always a drawing card to small central-station men, as well as large, and the Iowa and Ohio associations owe part of their success to the provisions which have been made for exhibits for several years past. These State associations have been in a general way following the experience of the larger national associations in finding the unsatisfactory features of parlor exhibits scattered through a

hotel. At the last two Iowa conventions ample exhibit space was provided free of charge, leaving to the supply men only the expense of providing an exhibit which, while not expected to be large, was nevertheless ample in the case of most of the new appliances in which central-station men are interested.

As concerns the work of the association aside from the exhibit feature, it is gratifying to note that the committee on "Facts and Factors," as shown by Mr. Austin Burt's report, has been much more successful in its efforts than in previous years and presented a compilation of data from 26 Iowa stations. This report took the general form which has been used of late in some of the central-station statistics presented in these columns. The comparison of these fundamental data of central-station business cannot fail to suggest to enterprising members of the association where improvements can be made in their own business. Consideration of various methods of increasing day load took up a considerable proportion of the time at the convention. The tungsten lamp, which was a novelty a year ago, has apparently become well settled in the business as a great aid not only in competing with private gasoline plants, but in securing additional consumers of all kinds. To judge from the testimony of those at the convention, the fears of revenue reduction by the coming of the tungsten lamps were absolutely unfounded. The lamp has had the opposite effect, as the broad-minded men of the industry predicted. If there is a central station which has allowed tungsten lamps to cut or reduce the total revenue, it must certainly be due to indifference and inactivity. To the progressive plants it has meant increase in every case. A brief running report of the convention is given in this issue, and abstracts of the papers and discussions will appear in later issues.

Methods of Computing Mean Spherical Candle-Power from Polar Curves of Candle-Power.

There are two known ways of deriving the mean spherical intensity of a luminous source from the polar curve of mean intensity in elevation. One is by some graphical method. The other is by some method of arithmetical computation, with or without a slide rule. Of graphical methods there are at least two in general use. Of arithmetical methods there are several, but they differ very little from one another. The *Elektrotechnik und Maschinenbau* contains an arithmetical method, noticed in the Digest, which is a slight modification of a well-known plan. It divides the polar curve into equal angular zones, takes the horizontal components of the intensities in these zones, finds their arithmetical mean and multiplies this by $\pi/2$ to arrive at the mean hemispherical candle-power. If the method were new it would be well worth discussing at length; but it deserves to be better and more generally known to illuminating engineers.

Determination of the Location of a Wireless Sending Station.

It will be remembered that on the occasion of the collision between the *Republic* and the *Florida* off Nantucket Island, about three months ago, in which the former sustained injuries that caused her to founder soon afterward, the rescuing steamer *Baltic* received the general wireless alarm when only 65 nautical miles westward of the scene of accident. Nevertheless, owing to the dense fog which prevailed at the time, the *Baltic* had great difficulty in finding the sinking vessel, although constantly in receipt of aerograms from her. If the bearings of the *Republic* could have been determined from the *Baltic* when the alarm signal came in, the latter vessel might have been able to cover the intervening distance in four hours. It actually took 12 hours of steaming over a zigzag course of some 200 nautical miles before the sinking steamer was reached, and even this might not have been possible had not the accident occurred in fairly shallow water on a steady gradient of sea bottom, so that the soundings from the drifting *Republic*, reported wirelessly from time to time, served as an additional guide to the searching ship. The incident shows how difficult it is to form an estimate of the whereabouts of a wireless signaling station from which messages are being steadily received.

A plan which has been suggested for the orientation of incoming signals is to erect a composite antenna of, say, four vertical wires, at the four corners of a square base, and compare the strengths of the signals received from different pairs of these four taken in regular succession. Such a structure does not, however, lend itself to the form and rigging of a steamer. It is also possible to use two vertical antennas, one, say, near the foremast, and one near the mainmast, connect them in series through receiving apparatus midway, and compare the strengths of the incoming signals as the vessel is swung in a circle. There should be two maxima and two minima of intensity, from which the bearing of the sending station might be estimated. But swinging a ship is a process that takes time, which may be ill spared for such purposes. Another plan for use in such a case is suggested by Herr Bela Gati in his article on page 1026. He proposes that the strength of the incoming signals be measured on a suitable type of barretter receiver. According to the observations of Duddell, the strength of received current, everything else remaining the same, is inversely as the distance from the sending station, at least up to a distance at which the observations terminated. Since the power of the incoming signals is proportional to the square of the received current, this leads to the conclusion that the power of the signals varies inversely as the square of the distance. If, then, the strength of the outgoing signals is maintained constant, and the strength of the incoming signals is measured from time to time as the receiving ship moves along, the direction of the sending ship can be deduced within certain limits. For instance, if the signals get weaker, the ship is proceeding in the wrong direction, and if they fail to get stronger, the line of advance must be across the line connecting the two vessels.

It is theoretically possible, as the article points out, to make two runs on courses of defined length and direction, and from the three received current strengths at the beginning and end of the runs, as well as the intermediate turning point, to compute the distance of the sending station from the location at the end of the runs. But it is not even necessary to make a computation. The same result can be attained graphically. The first run AB may be laid off on the chart in length and direction and, with center A, a circle may be drawn with a radius equal to n/i_1, where n is any convenient number and i_1 the received current at A. Similarly with center B, another circle can be drawn with radius n/i_2. The two circles will mutually intersect at two points. By repeating the operation

with new arbitrarily assigned values for n, similar pairs of intersection points may be obtained in a few minutes without any calculation. The locus of all such points will be an ellipse having its major axis upon the line of the course prolonged at one or the other end. The ellipse also intersects the course perpendicularly. The sending station will theoretically lie somewhere on this ellipse, if no drifting has occurred during the run. If now the course be changed at B along a line BC on the chart, a similar set of intersecting pairs of circles can be drawn from the centers B and C as before, and the elliptical locus of these intersections can be arrived at graphically after a few trials. The sending station will then lie theoretically at one of the two intersections of these locus ellipses, and it will be easy to see which junction is the position sought because, in general, one position only is a possible one in view of the three received current strengths i_a, i_b and i_c. For the greatest precision, the two courses AB and BC should in general have the same length and be mutually perpendicular. It is much easier to lay out such a plan of operations comfortably on paper with the courses laid down on the chart in advance and the sending station sending signals at convenience and on schedule time than in foggy weather, on a rolling ship, with the sending station in imminent peril of sinking, and all officers under a great tension. Nevertheless, the plan seems capable of service to some extent at least.

Some Fallacies of Street Lighting.

We greatly regret to observe that the ghost of candle-power contracts, supposed to have been safely laid at Colorado Springs, is still walking. The National Electric Light Association, which ought from bitter experience to know better, is in part responsible by reason of the extraordinary illumination proposition it put through at a recent convention, a resolution that should have been entitled "An Act to Promote Misunderstandings and Litigation." This aside, one finds in N. E. L. A. reports, even at this late day, ratings of street arcs as of 1200-cp or of 2000-cp ratings which by the layman are taken as descriptive and made the basis of assumed equality in the comparison of the prices charged for street service. We wish there could be permanent cessation of such foolishness and that street lights could be sold for what they are and not on the basis of ratings known to be erroneous. In the earlier days of arc lighting a 2000-cp arc meant just one thing—an open direct-current arc taking 9.5 amp to 10 amp and 45 volts to 50 volts at the lamp. It therefore created no confusion to have an erroneous candle-power rating, since the buyer knew very early in the game that the rating was a humbug. At the present time, however, one can find in the tabulated data published from various sources direct-current, open arcs as above, direct-current enclosed arcs at anywhere from 5 amp to 6.6 amp, alternating enclosed arcs at 6 amp to 7.5 amp and even 300-watt magnetite and 250-watt titanium arcs all posing as of 2000 cp. It would take the wisdom of the serpent to assign the real candle-powers to such a collection, but all of them are enormously below the rating and they vary among themselves by 100 per cent or more whether one reckons candle-power or effective illumination.

Hence, any attempt to reckon the comparative prices charged for arc lights in various cities from data based on rated candle-power is mischievous and misleading. One city may use 5-amp, direct-current, enclosed arcs and another 9.6-amp open arcs; one a 6-amp, alternating arc and another a 7.5-amp of similar sort, all through careless precedent rated at 2000 cp and burning the same number of hours per year. Their values for street-lighting purposes vary over a range of more than 100 per cent, and without an exact knowledge of the characteristics of each type, comparisons of prices charged mean nothing at all. To a large extent the central stations are responsible for the continuance of the old ratings, and if those thus offending were the sole victims of the resulting misunderstandings, it would merely be making the punishment fit the crime. Unhappily, the innocent suffer for the sins of the guilty in such matters. The only safe and honest policy in selling street lighting is to sell what is actually delivered; i.e., service for a specified time and under specified conditions with a known illuminant which is satisfactory to the customer. In this way one can avoid what is perhaps the most impracticable and silly stunt that ever entered into the litigious mind to conceive—the measurement of arc lights *in situ*. If an arc must be measured for light, take it down and put it into a sphere photometer and burn it under standard conditions long enough to get a fair average performance. Even so it is no easy job to check the candle-power with any fair degree of precision—such precision, for instance, as would be required if payments for service were made rigorously proportional to candle-power.

Another common fallacy is in attaching undue value to small units. It is, of course, demonstrable that one can by proper distribution get more uniform illumination from small than from large units. Properly planned lighting with small units can be made very effective indeed. But the mere substitution of small lamps for large without holding up equality of energy, or for that matter luminous flux, hurts the case of the small unit. One cannot under any ordinary conditions obtain equality of cost and retain equality of light. For instance, one may replace an arc lamp by three 60-cp incandescents without change of price and will doubtless get a higher minimum illumination by the change; but to get the same flux of light available on the street one would have to install five or six incandescents instead of three. Subdivision of units increases the cost of service, and if equally good lighting is required one must watch carefully lest it also increase the total costs. A question of degree enters the case, in that a street really well lighted by arcs cannot at usual prices be equally well lighted by incandescents at the same price, while a very badly lighted street may often be improved with positive economy by the same substitution. For instance, to light a street up to the London idea of proper light as recently expressed by Mr. Voysey—namely, 0.1 foot-candle measured on a horizontal plane 4 ft. above the pavement—by the use of incandescents would be a rather expensive matter, while in Sculch City, Ark., lighted by 6.6-amp alternating arcs spaced 40 rods apart one could safely bet on the advantages of small units. A degree of common sense has to be applied to these things. Sculch City pays perhaps $65 per year for its arcs, but it gets scant value in service as compared with cities that require first-class installation under ground. One cannot safely go into theoretical comparisons in street lighting and should stick very closely to the actual facts if he proposes to obtain results of any practical importance. Theory is all right and extremely valuable in its proper place. It cannot, however, jump at or over the facts and still lead to useful results.

Annual Report of General Electric Company.

The annual report of the General Electric Company has been issued under date of April 22, and covers the operation of the company for the year ending Jan. 31. The following is a comparison of the sales billed and orders received for the past four years:

Years, ending Jan. 31.	Sales billed.	Orders received.
1906	$43,146,902	$50,044,272
1907	60,071,883	60,483,659
1908	70,977,168	59,301,040
1909	44,540,676	42,186,917

The profits of the company for the past year (including $35,918 for securities sold and $1,453,942 from royalties, dividends, interest, etc.), and after deducting all patents, general and miscellaneous expenses, fixed charges, allowances for depreciation and losses, and writing off $1,524,295 from factory plants, were $4,802,250. After meeting dividend payments there was a deficit of $411,773 which was charged to the surplus account. This latter account footed to $16,102,062 on Jan. 31, 1909.

The report states the year of 1908 was marked by severe and continued depression in the business of the company. The value of orders received during the year was only 70 per cent of that for each of the two previous years, and shipments to customers only 63 per cent of the shipments for 1907. The great and sudden shrinkage in the business has, because of the difficulty in reducing expenses, resulted in great increases in the ratio cost of selling prices, with a corresponding decrease in the percentage of profits. It is stated, however, that since the close of the year these conditions have improved, and the outlook for the ensuing year is said to be encouraging. Notwithstanding the smaller amount of business, the total number of separate orders and contracts received was 248,384 as compared with 236,864 for the preceding year, an increase of 11,520. The average value per order, however, was 30 per cent less. During the year there was expended in acquiring patents, for licenses under patents, and in patent litigation, $929,109, which amount was charged to profit and loss. During the past year the plan of decentralization is stated to have been continued with satisfactory results. Each line of apparatus, such as switchboards, induction motors, steam turbines, meters and transformers, has been placed in its respective separate building or factory. Each group is supplied with a special set of engineers, manufacturing staff and clerical force, with a separate factory accounting system.

The total floor space of factories on Jan. 31 was 7,000,000 sq. ft., and the number of employees, 23,300. Among the buildings completed during the year was one with 142,000 sq. ft. floor space at Schenectady for the manufacture of wiring devices; a building of 99,000 sq. ft. floor space at Lynn, for the production of meters and instruments; an iron foundry of 59,000 sq. ft. floor space at Pittsfield, and buildings of 92,870 sq. ft. for lamp works. Work has been resumed on a building of 71,000 sq. ft. at Pittsfield, to be used as carpenter and pattern shops, and for pattern storage.

Vice-President E. W. Rice, Jr., in his report states that experience in the use of the high electric pressures of from 60,000 to 100,000 volts, needed for the economical distribution of electricity over very long distances, has been so satisfactory that higher pressures up to 150,000 volts are being considered in pending propositions. In this connection, it is stated that the sales of transformers of 60,000 volts and over in 1908 were nearly double those in 1907. Many improvements have been made in switches for the control of high-tension circuits, and there have designed and placed in commercial operation switches capable of controlling 110,000 volts, which is the highest voltage now in practical operation.

Two 14,000-kw turbines, placed in operation in Chicago, and two in New York, have proved satisfactory in every respect, and orders for additional units of the same size have been received. The company engineers have completed the design of a number of turbine generators for operation by low-pressure or exhaust steam. The economic value of these machines is based upon the fact that steam turbines are much more efficient than steam engines in the lower range of steam pressures between atmospheric pressure and a good vacuum. Turbines of this character have been designed up to 500-kw capacity, and it is expected that they will, by utilizing the exhaust steam from one of the existing engines, increase the capacity of the combined unit more than 40 per cent with a substantial reduction in coal consumption. The Curtis steam turbine has been adapted to the driving of centrifugal pumps and the city of San Francisco has purchased eight 750-hp and four 600-hp turbine pumps for a high-pressure water system. This is the first important application of steam turbines to this class of service.

The new type of commutating pole railway motor has, it is stated, proved most satisfactory in practical operation and large numbers have been sold. Several new sizes have been developed during the year. The 1200-volt railway system has been further perfected and the installations already made have proved an unqualified success. The vertical type of rotary converters of our design has continued to give satisfaction and many additional installations have been made during the past year. They are of particular value because of the saving in space afforded by the compactness of design. A number of these vertical rotaries is being built of 2500 kw capacity, which are the largest rotaries ever constructed. An especially interesting application of electricity is exemplified in an order received during the past year for the complete electrical equipment of two power stations and an electric transmission plant furnishing power and light for the construction of the dam at Gatun, Isthmus of Panama. The order includes 12 special electric locomotives and a number of special motors required for this work.

Publicity Work of the Public Service Corporation.

An interesting publicity campaign has recently been begun by the Public Service Corporation of New Jersey with a series of advertisements appearing not only in the Newark papers, but in as many as 25 dailies that are published in 12 different cities. Mr. J. L. O'Toole, head of the company's publicity department, informs us that with its railway service, electric lighting and gas it reaches and caters to the necessities of more than 150 separate municipalities in 11 counties of the State; its chief territory being virtually, as is well known, the northern portion of New Jersey.

In some of the recent work of this kind, companies have deemed it necessary to take a full page, but none of the "ads" of the Public Service Corporation now referred to is so large. Their standard size seems to be about 10 in. long by 4½ in. wide, and in that space the company manages to say a number of interesting and pertinent things, which are admirably directed toward enlisting the good-will and appreciation of the community addressed. The fact is set forth that the corporation has already spent more than $30,000,000 in the improvement of its properties, which means, of course, improvement to no less an extent in the facilities given. It has increased its electric lighting and railway generating capacity from 47,700 kw in 1903 to 102,900 kw in 1908, with 15 power plants and 14 substations. It has added 860 cars of the most modern type, extended its 5-cent fare zones, increased its transfer privileges, put into effect a 10-cent base rate for electrical energy, whereas many customers formerly paid as much as 18 or 20 cents; and it has increased its gas mains from 1335 miles in 1903 to 2037 miles in 1908, also making dollar gas almost universally available throughout its territory. It furnishes electrical energy for business places and residences in 138 cities and towns; trolley service in 118 and gas in 113.

These are impressive figures. The corporation has no less than 675 miles of electric track in 10 counties, with 88 separate lines of cars, and about 1400 cars in steady operation, making a distance of 108,506 miles daily. Last year it gave 294,110,602 rides, so that it carried the entire population of the State 137

times over. At some points the traffic is very dense. Over one crossing in Newark, 534 cars an hour pass during the evening rush—nine every minute, or a headway of barely seven seconds. These little facts escape attention generally, but it is remarked: "Public Service is not finding fault with the 'hurry-up habit.' Nor does it possess the ability to change it. Reasonable men, it hopes, will appreciate the difficulties it has to contend with. Unreasonable men—well, it's pretty hard for anybody to satisfy unreasonable men." Data are also issued as to the transfers at no fewer than 230 points.

Week by week these statements come out, each conveying in some form an idea of the great work the corporation is doing. Nor is the inference favorable to the company always left to implication. The various points are made very frankly and incisively, and one passage may here be quoted from a comment on the fact that troubles and delays must be inevitable with such a vast amount of business: "We are not finding fault with honest criticism. On the contrary when just criticism is offered in a spirit of fairness we will welcome it and try to profit by it, but we do not think we should be measured by the standard of the irresponsible critic who puts surmise forth for facts, lets prejudice supplant judgment, or permits a plain grouch to take the place of reason." So far, no cuts or diagrams have been used, and no large type. It is all plain, quiet speech with a brief heading that sums up the topics discussed.

The Convention of the Iowa Electrical Association.

The Iowa Electrical Association held its annual convention at Cedar Rapids, April 21 and 22. The registration of central-station men was nearly 100, while the guests and supply men brought the total registration over 200. This does not include the registration at the Iowa Street & Interurban Railway Association convention, which was held April 22 and 23. The local arrangements were along the lines followed by this association for several years past, with some improvements. The supply men were given free space for exhibits, and the exhibits were convenient to the convention hall. The American Auditorium Building was used for this purpose, the auditorium proper being occupied by the exhibits and the convention sessions being held in one of the committee rooms. The arrangement was such that it brought out an electrical show of no mean proportions.

This common-sense method of handling the exhibit problem undoubtedly brings out many central-station men who would not otherwise come because the absence of exorbitant charges for exhibit space brings more exhibits. Incidentally, the local central-station company, of course, profits indirectly by the publicity given to electrical matters and the throwing open of this exhibit to the general public.

The first session was called to order Wednesday morning by President L. D. Mathes, of Dubuque. The address of Mayor J. T. Carmody welcoming the association to Cedar Rapids was responded to by Mr. F. J. Hanlon, of Mason City. President L. D. Mathes in his address called attention to the revolution that had been going on in electric lighting the past 12 months because of the tungsten lamp. He then referred to the trend of public sentiment mentioned by President Carson last year toward all kinds of legislation affecting public-service companies.

This is in many cases the result of the making of an issue by professional politicians upon which to get into office. Many of the bills introduced into the Iowa Legislature regarding public-service corporations were of such an origin. He was glad to say, however, that all these efforts were defeated and none of the injurious measures passed. He regarded this as a proof of the fair-mindedness of most of the men in the State Assembly. It had been charged that a powerful lobby was being maintained at Des Moines by the public-service companies. Mr. Mathes characterized this emphatically as "buncombe." Representations of these interests, it is true, went to Des Moines and were heard on the proposed bills, as they had a perfect right to be. They certainly would have been lacking in alertness were they to let such legislation go through because of indifference and failure to adequately present their side of the case.

One of the important issues which has been brought up is that of a public-service commission. In this connection Mr. Mathes remarked that it was surprising how many electric lighting company men have but little conception of the public-utility commission problem and have given but little thought to its possible effect on their business. Mr. Mathes thought that the past year had been one of reasonable prosperity to the industry and that it was recovering well from the effect of general contraction of business.

Mr. Austin Burt, as "Facts and Factors" committee of the association, then made a very interesting and valuable report. Mr. Burt in preparation of this report had compared central-station facts and factors from 26 Iowa stations of various sizes. The form of report was identical with that recently used by the *Electrical World*, to which Mr. Burt made acknowledgment. The table of Mr. Burt's report, which will be given in a later issue, covers stations operating in towns of 1100 to 85,000 population.

Mr. J. G. Boyd, "Statesman" for Iowa of the Sons of Jove, was accorded the floor for a few minutes to speak on that

PRESIDENT-ELECT O. E. BROWNELL.

organization. Mr. Boyd said a few words about the objects of the order and said that it was proposed and desired to form a branch in Iowa. He announced that a rejuvenation would be held the following evening.

Mr. O. E. Brownell, of Lake City, opened a discussion on portable vacuum cleaners by reading a paper on that subject. From the discussion it appears that a number of central stations are stirring up interest in vacuum cleaning in their respective communities in order to popularize electric service and increase the day load. The discussion of this subject occupied the rest of the first morning's session.

Wednesday afternoon was opened with the report of the committee on grounded secondaries. In the absence of Mr. Thomas Sloss, of Cedar Rapids, chairman of this committee, Prof. F. A. Fish, of Ames, another member of this committee, read the report. This report stated that the committee had not been able to carry on the tests on the efficiency of various types of ground in Iowa soil which had been hoped for a year ago. However, the State engineering experiment station at Ames might be able to take up some of this work with its annual appropriation the coming year. The committee's report quoted at length from the A. I. E. E. *Transactions* paper by Hayden, Vol. XXVII, No. 3, giving results of tests on iron-pipe grounds. A letter from Dr. C. P. Steinmetz on grounding of secondaries was also embodied in the report. After some discussion on

methods of grounding, it was voted to continue the committee for another year to investigate this subject more thoroughly if possible.

Mrs. L. D. Mathes, of Dubuque, read a paper on "The Application of Electricity in the Modern Home," accompanied by demonstrations of meat roasting in an electric oven. This paper, which went very fully into some of the domestic processes in which electricity can be applied, was followed by a short explanation by Miss Jennie Michel, of Dubuque, a domestic-science expert, who gave some technical points regarding the use of the electric oven in roasting. In connection with this demonstration, the Steckline fireless cooker, designed by Mrs. Mathes and Mr. Steckline, of the Union Electric Company, of Dubuque, was shown. This is a well-insulated oven construction, employing for heat a 7-in. disk stove placed inside.

A general discussion of introduction of electric cooking followed, from which it appeared that complete electric cooking outfits are not making much progress, but that a large number of small cooking devices are being placed on central-station lines. Following this discussion a very hearty vote of thanks was given Mrs. Mathes for appearing before the convention with her wealth of information on domestic science subjects electrically applied.

Mr. Thomas Ferris, of Osage, discussed in a paper the effect of the tungsten lamp on central-station revenues. He thought in general the effect had been good. This, of course, was a fruitful source of discussion in which some figures on the life of tungsten street lamps at Cedar Falls were given by Mr. J. P. Jones. The whole trend of the discussion was that central-station revenues had not been reduced by the coming of the tungsten lamps, but that a very important weapon for putting gasoline lighting plants out of business had been put in the hands of central-station men.

The convention then took up the subject of ornamental curb-line illumination, upon which Mr. D. F. Fradette, contract agent of the Des Moines Electric Company, gave a short paper. This paper reviewed curb-line illumination in a number of cities, finally describing that in use on the business streets of Des Moines.

Wednesday evening a reception was held at Hotel Montrose, the headquarters, where opportunity was given to meet the members of the Commercial Club of Cedar Rapids. The courtesies of this club were extended to all convention visitors registered. After the reception the exhibits were again visited by many members.

Thursday morning session was opened with a paper by Mr. A. Harrison, of Nevada, on "Twenty-Four Hour Service in a Town of 2500 People and Methods Adopted to Increase Daylight Load." While admitting that local conditions alter cases, Mr. Harrison expressed the opinion that conditions are generally very similar in most Iowa towns, and that in such towns a population of over 2000 is sufficient to support daylight operation. While there is not much manufacturing, there is other load in the shape of water pumping and miscellaneous small motors that can be picked up. He then described the various schemes successfully used in working up a day load in a town of 2500 population. This was followed by an experience meeting in which various members told of their success in starting day circuits in small towns.

Mr. M. P. Ellis, of the Holophane Company, presented a paper entitled "Aid of Prismatic Reflectors to High-Efficiency Units." This paper brought out some discussion on the cleaning and maintenance of lamps and reflectors by central-station companies to prevent discredit to electric service.

A discussion on the progress in the introduction of heating units by central-station companies was led by Messrs. E. L. Callahan, heating specialist of the General Electric Company, and H. T. Holland, Chicago manager of the Pacific Electric Heating Company. This discussion was largely on methods of best introducing some of the better-known electric heating devices. The question of the desirability of electric heating load has come to be taken for granted, because it usually means additional revenue without additional investment. Methods of handling rates for heating appliances were also discussed.

At the closing session on Thursday afternoon Mr. J. B. Lindl, of Dubuque, told "The Story of a Successful Sign Campaign, with Facts and Figures." This gave the results of a very short and successful campaign for the introduction of electric signs at Dubuque, which was successful after several years of unsuccessful effort and considerable money had been expended. This also brought out a good discussion.

Mr. E. M. Sterns, of Humboldt, gave a short paper on "Selling Electrical Domestic Appliances in a Small Town." He described efforts to work up day-load revenue in a town of 2000 population in which the chief possible source of such revenue was from domestic appliances.

"The Importance of Close Inspection of Customers' Installations" was the subject upon which discussion was opened by Mr. W. J. Greene, of Cedar Rapids. This took up the importance of reducing fire risks and other hazards by inspection of the wiring in buildings connected. It was brought out that while such inspection may fall to a municipal or insurance inspector, the company may have to make inspections in self-defense, especially if there is no other inspection provided. Two cases of death caused by ungrounded secondaries were brought out.

Mr. L. D. Mathes spoke a few moments on the importance of a broad-gage policy in dealing with customers. This is especially important in dispelling the popular dislike of public-service corporations which has been due to the indifference of some such large corporations to complaints of consumers. Mr. Mathes said that this burden of criticism had been thrown on smaller companies because of the indifference of some of the larger companies, particularly in the East. This is now a matter of past history, but it takes this impression of the public a long time to wear off.

At this stage of the proceedings, Mr. George S. Carson, on behalf of the convention, presented President Mathes with a handsome watch-fob in recognition of his unusually able efforts and successful accomplishments as president of the association this year. President Mathes' remarks on various subjects as they came up for discussion not only served to bring out the best that was in the convention, but were in themselves very instructive and helpful. That his efforts had not been lacking during the year was shown by the excellent program presented.

The convention then went into executive session and elected the following officers for the ensuing year: President, Mr. O. E. Brownell, of Lake City; vice-president, Mr. Thomas Crawford, of Clinton; secretary, Mr. W. N. Keiser, of Des Moines; treasurer, Mr. W. A. Mall, of Belle Plaine. Executive committee: Messrs. A. L. Dodd, of Charles City; Edward Reavy, of Davenport, and Gus Lundgren, of Cherokee. The next meeting is to be held at Sioux City, at a date to be fixed by the executive committee.

The convention was indebted to the Cedar Rapids & Iowa City Railway & Light Company and the Cedar Rapids & Marion City Railway Company for a theater party Thursday evening and also for an automobile ride given to the ladies of the convention on Thursday.

Mr. O. E. Brownell, president-elect of the association, is the proprietor of the electric light plant at Lake City, Ia., which he has owned for five years. His election as president of the association well illustrates the important part the small companies play in the Iowa Electrical Association, and the way in which it caters to their needs and is supported by them. Mr. Brownell was born and brought up at Winterset, Ia., and received a common-school education. He is 38 years old, and his experience in the electric lighting business dates back 17 years, when he began work at the old water-power station in Des Moines. Much of his early training was received in the employ of the Des Moines Edison Company. Prior to his purchase of the Lake City plant he was chief engineer of the State hospital at Mount Pleasant, Ia.

Abstracts of the more important papers and discussions will appear in later issues.

The Niagara Ice Jam.

The dangers from the Niagara ice jam became so pronounced last week that Collector of Customs John A. Merritt, of the Port of Niagara Falls, called upon the U. S. War Department to instruct its engineers at Buffalo to make an examination to see if they could afford relief. This national department did nothing, and President Sanford White, of the village of Lewiston, wired Governor Hughes to suggest a plan of relief. This resulted in the State Department of Public Works taking up the question, and within a few hours Assistant Superintendent Kunze was on the scene. He at once determined to employ dynamite to break the jam. Two tons of this explosive were hurried from Buffalo to Fort Niagara by night, wagons carrying it across country, and last Thursday morning the work of placing the dynamite began. By noon all was ready for the first blast. During that afternoon other blasts were fired, but at nightfall the results did not appear to be much, so far as fracturing the jam was concerned, but Friday morning it was with rejoicing that it was observed the water had settled back. This recession of the water continued until the river was about normal, and on Saturday the ice began to break away at the mouth of the river and at various places toward Lewiston. On Sunday the channel opened still more, and then it was realized that the dynamiting at the mouth of the river had broken the jam so that the river was resuming its normal flow into Lake Ontario. With these conditions established, the fears of the people of the locality were much allayed.

During the latter part of last week the ice fell away to a considerable extent about the power house of the Ontario Power Company, but the ice jam between the upper steel arch and the whirlpool rapids was still fast at the opening of the week, this stretch of ice being in front of the station of the Niagara Falls Hydraulic Power & Manufacturing Company. When this report was written, the Ontario Power Company had not yet succeeded in getting its machines in operation, but the force employed was laboring hard with hope that successful results would be shortly forthcoming. Two of the towers supporting the aluminum cables that transmit power from this station across the river midway between the Falls and Lewiston for delivery to the Niagara, Lockport & Ontario Power Company have been knocked down by the ice.

When the water first receded in the gorge, the Gorge Railway Company was quick to set men at work clearing the line, but owing to high water coming again, operations had to be suspended temporarily until after the effects of the blasting were known. If no further trouble is experienced from ice and water, hundreds of men will be at work this week clearing away the deposited mass of ice and bringing the road out of its chaotic condition in order that repairs may be made previous to the influx of summer visitors. All transportation facilities along the river have been taxed by sightseers, the Niagara Falls Park & River Railway, Canadian side, finding itself a dividend proposition in what may be termed winter time, much to its surprise.

Proposed Limitation of Sale of Sanitary District Power.

Mr. B. F. Kleeman, who represents one of the southern districts of Chicago in the lower house of the Illinois Legislature, has introduced a bill in that Assembly to limit the power of the Sanitary District of Chicago in supplying electricity generated by the water-power of the Drainage Canal. The purpose of this amendment to the laws under which the Sanitary District operates is to make it mandatory on that body to sell, or offer to sell, the electricity generated to municipal bodies within the Sanitary District or adjacent to the main channel of the canal for the purpose of street lighting or for the operation of pumping plants or machinery used for municipal purposes or in the public service. It is provided, however, that before the electrical energy is sold notice shall be given to the mayors, aldermen or other competent officials of municipal corporations affected, that a certain amount of electrical energy is offered for sale and that this energy can be purchased at a certain price per horsepower, which shall not exceed the cost of production. If the municipalities decline to purchase the power within 60 days from the last publication of the notice, then the power, or the surplus which is not purchased by the municipalities, may be disposed of to any other person or corporation upon such terms as may be accepted by the Sanitary District. It is intended by this proposed law to give the municipal bodies the refusal of the power before it is offered to private consumers. The bill has been referred to the drainage and waterways committee.

Mr. Kleeman contends that inasmuch as this electrical energy is the result of the investment of the taxpayers' money, the taxpayers in the various municipalities affected (of which Chicago, of course, is the principal one) should have the benefit of the use of the electricity at cost for the purpose of street lighting, which is badly needed, or for other municipal service.

Accounting Section at the National Electric Light Association Convention.

In speaking of the plans which have been made for the sectional meetings for accountants at the convention of the National Electric Light Association, to be held at Atlantic City, N. J., on June 1 to 4, H. M. Edwards, auditor, New York Edison Company, and chairman of the Committee on Uniform Accounting, said:

"Sectional meetings for accountants as a feature of National Electric Light Association conventions were inaugurated at the Chicago meeting last year. At that time the interest was centered largely around the proposed classification of accounts which the Public Service Commissions of New York were considering, and hence the single session at Chicago was devoted largely to that subject and especially to the bearing of the proposed system of accounts on the question of depreciation.

"At the Atlantic City meeting this year there will be delivered six papers on live subjects, each of which affects the daily routine of the accounting department of every member company. The papers are written by experts, men who have reached high positions in the official staffs of their respective corporations. Surely such a program must interest accountants and, it would seem, should induce the management of every company to see that its accounting department is represented at these meetings.

"Much has been said and written of the value of association and of the beneficial and broadening effect on the minds of those in attendance at conventions. These benefits should appeal particularly to accountants, who, by the very nature of their duties, become conservative and find that their horizon is too apt to be bound by the walls of their own offices. The corrective to this condition is association with their fellows and the opportunity for discussion and comparison which such association affords. The association has now provided the opportunity and it behooves the accountants to take advantage of it.

"The accounting committee is very desirous of a large attendance and will do all in its power to make the meetings attractive, to see that the delegates become acquainted, and to give to everyone an opportunity to state his problems and, if possible, to find their solution."

The accounting section will hold meetings all day Thursday and on Friday morning. The following papers will be presented: "Branch Office Accounting," by Mr. E. J. Allegaert, auditor, Public Service Corporation of New Jersey; "Customers' Accounts," by Mr. L. A. Wallace, auditor, Edison Electric Illuminating Company of Boston; "Pay-Roll Problems," by Mr. W. W. Freeman, cashier, New York Edison Company; "Care and Handling of Supplies," by Mr. J. L. Bailey, treasurer, Consolidated Gas, Electric Light & Power Company, Baltimore; "Cost Accounting," by Mr. H. R. Kern, auditor, Philadelphia Electric Company; "Depreciation," by Mr. G. E. Claflin, United Electric Securities Company.

Electrical Distribution in Chicago.

Mr. H. B. Gear, general inspector of the Commonwealth Edison Company, Chicago, was the speaker at the luncheon of the Electric Club, of Chicago, on April 21. Mr. Gear's subject was "Distribution of Electric Light and Power in Chicago," and as he has made a thorough study of this subject and introduced a number of improvements in this class of work, his address was valuable and instructive.

Mr. Gear outlined the nature and extent of the transmission system of the Chicago company, mentioning the total mileage of over 300 in the 9000-volt, three-conductor, 25-cycle cable, and pointing out that a voltage of 20,000 has been adopted for the zone outside of a 10-mile radius from the generating station. About half of the energy delivered over the 9000-volt system is sold wholesale to the electric railways in and about Chicago. The remainder is delivered to light and power customers through 32 substations, 24 of which deliver direct current and eight deliver alternating current. Twenty-one of the direct-current substations convert the 25-cycle energy by means of rotaries and three are battery substations exclusively. There are 20 storage batteries, with a total rating of 18,000 kw at the one-hour rate, to protect the direct-current systems, which had a maximum load in December, 1908, of 38,000 kw.

Six of the eight alternating-current substations convert 25-cycle energy to 60 cycles by motor generators. These carried a load of 18,000 kw in December, 1908. The other two are straight transformer stations, taking their energy from the frequency-changing substations. The 60-cycle electricity is distributed to all customers outside the direct-current territory by means of four-wire, three-phase feeders at 2300 volts, phase to neutral, and 4000 volts between phases. Lighting and single-phase power are connected from one phase to neutral and three-phase power transformers are Y-connected, so that standard 2200-volt transformers are used throughout.

Single-phase motors are required from customers up to 5 hp, and larger ones are in use in a few cases when three-phase is not available. No three-phase service is given for less than 5 hp on account of the excessive cost of transformers and meters. Lighting installations less than 25 lights are connected two-wire at 115 volts. Larger lighting installations are connected three-wire at 115-230 volts. These voltages are the same on the alternating-current and direct-current systems.

All new underground lines have been constructed on the conduit and cable system for several years. Underground services enter buildings under sidewalks in business sections and at back or front lot lines in residence sections. The customer bears the expense of the lawn service and makes the decision as to whether it shall be underground or overhead.

Ultimately the company will have no poles on the streets of Chicago. Underground conduits will be used in the streets with overhead distribution from pole lines through the alleys between the streets to customers' premises. Chicago is fortunate in having numerous alleys, as it enables this convenient and economical system of distribution to be carried out to the mutual advantage of the public and the public-utility companies.

There are about 35,000 poles in the company's distribution system in Chicago, principally in alleys, as explained. Of this number, about 25,000 are occupied jointly with telephone, telegraph or railway companies. In nearly all cases there is but one pole line in an alley, as this makes it much safer and more convenient to have the service connections on both sides of the alley than would be the case if there were two pole lines. The number of accidents from broken or crossed wires is remarkably small. The electric light wires are on the upper crossarms with the telephone wires beneath, and there is a clear space of 5 ft. between the two sets of wires.

Answering questions, Mr. Gear said that it is not the policy of the company to extend the direct-current area, as with the present excellent performance of alternating-current motors, nearly every useful application of electricity can be served by alternating current. There is no two-phase service regularly in use anywhere on the company's system of distribution. A few alternating-current motors are operated on 440-volt circuits, but the company does not supply standard transformers for this voltage.

Mr. C. A. S. Howlett, president of the club, presided at the meeting and took part in the discussion, as did also Messrs. F. J. Postel, James R. Deane, Frank L. Perry and others. Mr. B. E. Sunny, president of the Chicago Telephone Company, had been announced to address the club on April 21 on "Chicago Charter Bills," but he was suddenly called from the city. It is possible that Mr. Sunny may talk on this subject at one of the club's luncheons at a later date.

New Electrical Musical Instrument.

On the evening of April 27, in Symphony Hall, Boston, a new electrical musical instrument, called the "Choralcelo," was formally presented to the musical world. This instrument, which is the result of many years of inventive application on the part of Messrs. Melvin L. Severy and George B. Sinclair, of Boston, is claimed to make possible an ideal of musical beauty hitherto unrealized, particularly in a stringed device. In previous instruments the musical note has been produced by some abrupt and more or less intrusive mechanism. A violin string, for example, is vibrated by a resined bow, with the result that many of the overtones are killed by the contact of the bow with the string, and so on through the musical art. The result has been that pure musical tones are not produced by ordinary musical instruments. In the choralcelo, on the contrary, it is claimed that, for the first time, the music of a stringed instrument is produced with no physical or material contact with the strings. In this instrument the vibrations are produced by an electromagnetic influence, leaving the strings free to pulsate from end to end with all the overtones which naturally belong to them.

While the instrument gives out rich, full tones representing a remarkable range in tonal and instrumental values, it is scarcely larger than an ordinary upright piano, and the operating mechanism is both simple and compact. An interesting feature of the music of the choralcelo is that the harmony floods the auditorium without appearing to come from any particular direction. By the introduction of suitable contacts at the keys the loudness of the sounds is electrically controlled, varying with little effort on the part of the performer from crashing chords to delicate harmonies. In the instruments thus far shown the piano-action has been left in the case, and one of the most interesting effects created has been by the simultaneous playing of the piano and electromagnetic operation.

The Symphony Hall program included alternate numbers by the choralcelo and by a band composed of about half the members of the famous Boston Symphony Orchestra, conducted by Gustav Strube. Although the choralcelo gives out a volume of sound sufficient to fill a large hall, the application of electricity in its mechanism is so simple and direct that the current consumption at the full musical output is only about 6 amp at 110 volts.

Pittsburgh A. I. E. E. Meeting.

The regular monthly meeting of the Pittsburgh Section, A. I. E. E., was held in Carnegie Institute April 13, preceded by the usual dinner at the University Club. Mr. W. Edgar Reed, chairman, presided. The subject of the evening was "Repairing Live Lines While in Service," which was considered in a paper prepared by Mr. J. S. Jenks, assisted by Mr. W. H. Acker, both of the West Penn Railways Company. Mr. Jenks showed by means of a large number of lantern slides the system together with the tools which he and his assistants have developed on their 25,000-volt lines in order to avoid the necessity for linemen to come in contact with the line conductors, and showed how completely equipped poles could be stripped of all wires and crossarms, and the insula-

tors, crossarms and conductors replaced without interrupting any circuit. The paper excited a lively interest among the body of engineers present, which included representative men from all the large electrical companies and public-service corporations in the territory. The discussion was participated in by Messrs. H. N. Muller, D. E. Burke, W. H. Acker, N. W. Storer, A. J. Glenn, F. F. Espenschied, O. M. Jorstad, H. A. Calderwood, Graham Bright, R. A. L. Snyder and Bertrand P. Rowe.

The next meeting of the section will be held on May 11, when a paper on electric lighting will be presented by Mr. C. E. Stephens, of the Westinghouse Electric & Manufacturing Company.

Massachusetts Legislative Notes.

A notable victory was secured by Speaker Walker, of the House of Representatives, during the past week in the killing of the East Boston 89-cent gas bill after it had reached an advanced stage in the legislative calendar. Although the measure itself appeared harmless on its face, it would have seriously injured the policy of the State with respect to the supervision of public service corporations by trained commissions had it been passed. Even if the Governor had vetoed the bill it would have been an expression of little confidence in the work of the Gas and Electric Light Commission, on the part of the Legislature, although for 20 years this board has borne a reputation for impartial dealing and has repeatedly shown itself qualified to deal with problems of rate-making. As Massachusetts is thoroughly conservative in its regulation of public utilities, it is a source of general gratification that the House rescinded its action on the bill after the injury to investors and the discouragement to industrial conditions in the State which were entailed had been made plain by the speaker.

The joint committee on ways and means has reported favorably on a bill to provide for an investigation of the water resources of the State, and the bill has been given a second reading in the House.

The bill to authorize the Heath Telephone Company to sell stock privately has passed the House to be engrossed and has been sent up to the Senate for concurrence.

The electric lighting consolidation bill providing for the absorption of the electrical business and equipment of gas companies by central stations has been given a third reading in the House. It is probable that this bill will pass at this session, and it is understood that the purchase of several of the suburban electric properties by the Boston Edison Company will be brought promptly before the Gas and Electric Commission for approval if the bill becomes law.

The Senate has given a first reading to the adverse report of the committee on Mercantile Affairs on the Reidy bill relative to telegrams transferred from one company to another.

The Dean bill on the taxation of foreign telephone and telegraph companies has been killed by the two houses in concurrence.

The bill to permit the Connecticut River Transmission Company to build lines over certain lands of the State on approval of the Metropolitan Water and Sewerage Board has been referred to the committee on metropolitan affairs.

The report of the committee on taxation against the Reynolds bill for legislation seeking the taxation of telephone and telegraph companies has been accepted by the Senate.

New York Public Service Commission News.

Both branches of the New York General Assembly have now passed what is known as the Travis-Robinson bill which amends the rapid transit act so as to permit the building of additional subways in New York City with private capital. The bill is now ready to be sent to the Mayor for his approval. It provides that the Public Service Commission, with the approval of the Board of Estimate and Apportionment, may grant a franchise to a private corporation and that the railroad shall be built at the expense of the holder of the franchise. The right of the city is reserved to terminate the franchise after 10 years on specified notice and to buy the property at a sum not exceeding the actual cost of the plant, with 15 per cent added for engineering expenses. The bill also provides for the building of rapid transit roads to be owned by the city at public expense and gives the commission and board of estimate the power to determine whether all or any portion of the expense of construction shall be assessed upon the property benefited by the improvement.

No action has yet been taken in the Assembly upon the Travis-Lee constitutional amendment removing the cost of self-supporting subways from computation in the city's debt limit. In the Senate the bill amending the public service law, which was passed last week by the Assembly, was placed upon the calendar, but objection was made to advancing it out of its regular order and putting it upon its passage. The bill may be lost for lack of interest on the part of the senators.

At the public hearing before the Public Service Commission upon the application of the Hudson & Manhattan Railroad Company for a franchise to run a subway under Sixth Avenue to the Grand Central Station the only objection that was made came from Everett P. Wheeler, who represented certain holders of traction securities and who asked that the commission look more closely into the financing of the project. The attorney for the Interborough Rapid Transit asked that a provision be incorporated in the franchise prohibiting the McAdoo system from extending its station at Forty-second Street and Fourth Avenue further north than the middle line of the former street. There now seems to be little doubt that the franchise will be granted.

The executive committee of the Washington Square Association, of which Thomas F. Ryan, largely interested in the Metropolitan system, and F. W. Whitredge, receiver of the Third Avenue Railroad Company, are members, has filed a protest with the Public Service Commission objecting to the proposed double-tracked subway of the Hudson & Manhattan Railroad under Ninth Street from Sixth Avenue to Fourth Avenue. The protest is based on the possible injury to property in the neighborhood and suggests that as the McAdoo system will tap the present subway at Forty-second Street, it is unnecessary to build the Ninth Street spur. In connection with this protest it was made known that already the excavations for this line had been completed about halfway of the block between Sixth Avenue and Fifth Avenue. It was also practically given out that the McAdoo Company had no intention of abandoning this work, but expected to take it up as soon as the proposed line to the Grand Central Station has been completed. The company already has the necessary franchise for this branch.

The Public Service Commission of the First District of New York has held a hearing on the application of the Pelham Park Railroad Company and the City Island Railroad Company to issue $100,000 of bonds for refunding purposes and for the construction of a monorail line between Bartow Station on the New Haven Railroad and City Island. The refunding portion of the new bonds will amount to $55,000, and the balance will be spent for the construction of the monorail system.

At the "Rapid Transit" dinner, given by the Reform Club of New York City, April 26, Milo R. Maltbie, member of the Public Service Commission for the First District, outlined the position of the commission with regard to profit-sharing between the city and transit corporations. "The rapid transit policy of the commission," he said, "contemplates a sharing of all profits above a certain fixed minimum. According to the amendments to the law proposed by the commission there is to be deducted from income operating expenses, taxes, payments to reserve and amortization funds and a return upon the investment not to exceed in any case 6 per cent. The remainder is to be divided equally between the company and the city. In other words, if the company were to make 9 per cent in any one year after paying all charges except interest and dividends,

and if the agreement fixed 5 per cent as the limit, the city would get 2 per cent and the company would get 2 per cent, the latter as an extra dividend to its stockholders. If only 7 per cent were earned the city would get 1 per cent and the company 1 per cent, or 6 per cent in all." All the funds received by the city from such sources are to go toward paying interest and sinking fund charges upon municipal bonds issued to build and equip rapid transit lines.

Meeting of New England Section of Illuminating Engineering Society.

The regular monthly meeting of the New England Section of the Illuminating Engineering Society was held at the Edison Building, Boston, on April 20. The speaker was Mr. L. D. Gibbs, assistant advertising manager of the Edison Electric Illuminating Company, of Boston, his subject being "Store Window and Sign Lighting." Mr. Gibbs sketched the development of illumination for mercantile establishments from the earliest days of oil lamps and gas down to recent times, and pointed out that much of the poor lighting of the past was due to the failure to realize that intelligibility, legibility and artistic effect do not necessarily follow the unrestricted or undirected use of a large quantity of light. A light may be more of an obstruction to trade than otherwise if it is not installed according to correct principles. The illuminating engineer is perhaps handicapped because he is generally restricted to a close association with some commercial interest, but he is fortunate, on the other hand, to practice in a field where there is clearly a demand for his skill in progressive establishments. That the clientèle is receptive augurs well for the future of the illuminating engineer. The business man is in general looking for novelty, and this quality may easily be secured by lighting effects.

Mr. Gibbs then emphasized the importance of avoiding harmful physiological effects in store or sign lighting. Particularly in window illumination should it be realized that people prefer to look at displays from inconspicuous positions. Too much light outside the window tends to drive passers-by across the street, perhaps to return to the original side again after the offending glare has been passed. Merchants hire high-salaried men for their window decoration and the possibilities should be doubled with proper illumination. The merchant wants something dignified and yet attractive. Illuminating engineers should co-operate with sign builders, for there is room for improvement here. It might pay a merchant to keep two sizes of lights for use, the larger with darker goods and the smaller with lighter ones. Different sizes would work in well with different color schemes in the windows. A large number of lantern slides of representative window illumination were shown, with the object of bringing out the good and bad points of practice, and particularly to illustrate the importance of the comfort of the spectator. Outline lighting is a better feature in window work than outside illumination. It is a poor policy to repel the passerby by improperly distributed or too much light

A brief discussion followed the address. Dr. Louis Bell emphasized the importance of designing signs for legibility at greater distances and urged the value of complete concealment and proper direction in window illumination. The distance at which signs can be read is often absurdly small in proportion to the size of the sign and the amount of current used. Too few units and too small letters tend to produce blurring of signs at short distances, and the separation of the letters or their component lamps should be carefully considered. It is a good plan to get away from the spot-light effect. The point was also brought out that when a central station advertises electricity by an electric sign there should be some means of directing the inquirer to the company, installed on the sign itself. To print "Electricity is Cheaper: Wire Up!" is well, but the company's name should also be included.

Carbon Primary Cell.

Mr. Ernst Waldeman Jungner, the Swedish electrochemist, best known by his early work with the nickel-iron storage battery, has in recent years been engaged in finding a solution of the old problem of the carbon primary cell, and in a patent granted to him April 20, he describes a cell of this type. The electrolyte is concentrated sulphuric acid with certain additions to be mentioned below. The anode is amorphous carbon, while the cathode consists of graphite, unattackable by the electrolyte and in such a form as to be capable of absorbing atmospheric air. The simple reaction intended is the oxidation of the anodic amorphous carbon by means of the atmospheric oxygen supplied to the cathode. The function of the electrolyte is simply to permit the transfer of oxygen from the cathode to the anode. In this respect the cell is, therefore, of the "oxygen-lift" type, like the Edison or Jungner nickel-iron battery. But in the present case the anode carbon is gradually consumed, while the graphite cathode remains intact. The electrical energy is therefore produced at the expense of the carbon which forms the anode, and oxygen from atmosphere. The use of concentrated sulphuric acid instead of dilute acid is important, but has the disadvantage of high electrical resistance. Jungner, therefore, makes additions to the acid to increase the conductivity and at the same time render it easier for the electrolyte to absorb oxygen from the cathode or atmosphere and deliver it to the anode. Such additions are nitrogen oxide gases NO, N_2O_3, NO_2, or chlorine compounds of such gases, etc. The cell construction is not as simple as the intended reaction, and there is the further complication that the electrolyte must be heated. But Jungner claims that in his cell he utilizes 50 per cent of the combustion energy of carbon, which, of course, is an efficiency many times higher than can be obtained with the steam engine.

Electricity in a Modern Biscuit Factory.

Electricity furnishes the motive power for the largest biscuit factory in New England, which was recently completed in Boston by the Austin Biscuit Company at a cost of $1,500,000. The plant is the most complete cracker establishment in the world, the building, which is of reinforced concrete and brick, costing nearly $900,000. The factory is located at the corner of Causeway and Washington Streets, and is six stories in height, 330 ft. long and 107 ft. wide, with 1000 windows in the plant. The company manufactures 101 varieties of biscuit, and when completed to the designs of the owners its capacity will be 8,000,000 crackers in nine hours. Electricity is supplied to the plant from the company's installation in the basement of the factory. This means of driving the machinery and lighting the establishment was chosen on account of its cleanliness, efficiency and convenience.

The power plant consists of four 100-hp return tubular Robb-Mumford boilers operated at 125 lb. steam pressure, and three electric generating units aggregating 425-kw capacity. There are a Harrisburg horizontal high-speed 260-r.p.m. engine direct connected to a 75-kw generator; a Harris-Corliss horizontal 150-r.p.m. engine direct coupled to a 150-kw generator, and an engine of the latter make direct connected to a 200-kw 150-r.p.m. generator. All the generators and most of the motors in the plant were supplied by the Boston office of the Westinghouse Electric & Manufacturing Company. The generators are wound for 220 and 110 volts direct current, the higher potential being used throughout the factory for power service and the lower for light distribution. The distribution for the different floors is measured and controlled at a large switchboard in the basement and iron conduit carries the cables to the centers of supply at the different floor levels, whence smaller conduit runs to individual motors.

On top of the building are two electric signs advertising "Sunshine Biscuit," one on the roof and the other on the corner of the building so as to be visible from all elevated trains

which pass the structure. There are 1155 incandescent lamps in the two signs, 4-cp lamps in the middle of the sign, 8-cp on the border, and 16-cp on the sinuous flashing portion. The sign flashers are each driven by a ½-hp, 220-volt General Electric motor.

A cold storage equipment has also been installed. This is steam driven with the exception of a propeller used to agitate the brine in the ice tank. The propeller is driven by a 5-hp, 1600-r.p.m., 220-volt General Electric motor. There are two cold storage rooms kept at 30 deg. and 15 deg. Fahr. respectively, and the company manufactures its own ice. Four Otis electric freight elevators of a capacity of three tons each are installed, each driven by a 30-hp, 220-volt motor. A special feature of the elevator service is the installation of annunciator locks at the different floors.

The first use of electricity in the processes of the factory is on the sixth floor, where flour and other ingredients are mixed in motor-driven machinery. The tubs of dough are rolled under steel knives mounted in frames, and the dough is churned by these knives until it is ready to be set aside to rise. In the mixing room are a 30-hp, 1100-r.p.m. motor belted to two three-spindle mixers; a 30-hp motor belted to three-barrel mixers, and a 13-hp, 1350-r.p.m. motor driving three-barrel mixers, one at a time. The motors are all mounted on platforms suspended from the ceiling, with their starting boxes close at hand. On the same floor and extending to the floor below for firing are 28 ovens, 16 of which weigh 400 tons apiece, some being of the Ferris wheel type and others of the English endless-belt type, 45 ft. long. In the American division of the baking room are 12 motors of 13-hp capacity each, and each motor drives by group method one rotary oven, one cracker machine, one break for rolling dough, and one conveyor running to the fourth floor. In the English department the company has introduced machinery which has never before been used in America, operated by two 25-hp, 1150-r.p.m. motors, one motor being held in reserve. There are three cracker machines, two ovens and three breakers in this division. The rolling and flouring of the dough, the kneading, salting, cutting and stamping are all handled by these machines. Each of the larger ovens consumes half a ton of coal per day. The output of the men in this portion of the plant is about 10 times that in the days of hand labor.

In the packing department, on the fourth floor, a number of motors are used to expedite the process. The biscuits are brought down to this floor on patent chain carriers driven by the motors on the sixth floor. The cartons in which the biscuits are packed are made on elevated platforms and are carried to the packers by small conveyors, there being seven of the latter, driven by two 2.5-hp, 1500-r.p.m. motors. A special feature in connection with the bringing down of the biscuits from the upper floor is the cooling of the recently cooked product by 30-in. fans as the conveyors pass a given point in the packing department. These crisping blowers are each direct driven at 1500 r.p.m. by 2-hp motors. In this department there are also a 13-hp, 1350-r.p.m. motor driving a cracker meal grinder by belting, and a 60-in. fan driven by another 13-hp motor. This fan is used to exhaust air from a drying room where icing goods are kept for a short time, the motor being located outside the room to secure the necessary cooling operation.

On the third floor of the plant is the dipping department, where fancy goods of the iced varieties are given their necessary coatings by machinery. Here are six marshmallow kettles operated in connection with two icing goods trolleys by a 13-hp motor. The goods which are iced or frosted are not handled in the process but are carried along the room by a spindle conveyor for drying. The icing machine, two cake-cutting machines and two icing tables are driven by another 13-hp motor. On the second floor are two buffers and three nailing machines driven by a 13-hp motor, the company making all its wooden and tin boxes. A machine shop is also located on this floor and the various lathes, grinders, saws and other tools are run by a 30-hp motor, which is also connected by line shafting and belting to drive a sugar-bolting machine.

The new building and its equipment were planned by Mr. J. Schull Loose, of Kansas City, a director of the company. The chief engineer of the plant is Mr. W. F. Sayles.

Central-Station Revenue and Cost in Massachusetts.

In the analysis of central-station operations the practice of individual companies is interesting from the standpoint of the specific problem and its solution, while the combined results of many stations' operation throw a clear light upon the general tendencies of the industry. To study the revenue and cost of operation of the central stations in a whole State may be instructive to a considerable degree, even though such total figures represent no single plant that is in service. The recently published report of the Massachusetts Gas and Electric Light Commission for the year ending June 30, 1908, presents some significant total figures for the operations of all the companies in that period. Table I gives the distribution of income for the central stations of the State as made up from the following items:

TABLE I.

Income of all Massachusetts Central Stations, 1908.

Commercial arc-light service by contract	$90,302.64
Commercial incandescent service by contract	137,136.47
Commercial arc and incandescent service by meter	6,092,317.51
Public arc-light service	1,479,422.30
Public incandescent service	488,581.54
Electric power	1,825,729.34
Energy to other companies	237,433.09
Rent of motors	4,093.83
Rent of fixtures	14,705.59
Rent of meters	5,460.60
Steam-heating revenue	26,367.58
Total revenue from operation	$10,401,550.49

The companies earned approximately $630,000 more in 1908 than in 1907, and of this increase $400,000 was a gain in lighting business by meter rates. There was a decrease of approximately $29,000 in the flat-rate business compared with 1907, which indicates that the net new business in lighting by meter rates was about $370,000, or a gain of 6.5 per cent on the total meter lighting business of 1907. This was a gratifying indication of the progress of electric illumination in a year of depressed business. The sale of power was the second largest single source of revenue, the gain for power sales in 1907 being over $200,000, or 12.5 per cent. The percentage rate of increase of the power business was, therefore, approximately double that of the lighting business, but the total gain in revenue was less in the power field, on account of the lower rates prevailing for motor service. The total public-lighting service, arc and incandescent, slightly exceeded the revenue from power. In comparison with 1907 there was a gain in revenue from incandescent street lighting and a loss from the arc street-lighting service. As some of the public-lighting revenue probably is derived from municipal buildings, it is difficult to assign definite figures to the tendency toward more incandescent street lighting. The steam-heating business of the Massachusetts central stations was only $26,367 in 1908, about $11,300 less than in 1907.

Table II, on page 1016, shows the expenses of all the private companies of the State for the fiscal year 1908.

The largest single expense item was fuel, which was $160,000 larger than in 1907. Taxes came next, amounting to over $722,000. For every 3 cents paid in dividends the companies paid practically 1 cent into the public treasury in the form of taxes. About 12 per cent of the total expenses were due to taxation. It is significant that neither station wages, plant repairs, line repairs, lamps nor general salaries were as high as the item of taxes. There was a decrease of $14,000 in taxes compared with 1907. Station wages were about $70,000 greater in 1908 than in 1907. The reliability of electrical machinery as compared with steam equipment is indicated by the relative proportion of repairs, which was maintained in 1908 as well as in 1907.

The companies purchased about $2,000 less in carbons in 1908 than in 1907, indicating a slow advance of incandescent street lighting. The purchases of incandescent lamps increased about

20 per cent in 1908 compared with 1907, or by about $50,000. The companies spent approximately $63,000 more in 1908 for line maintenance. The total operating expenses increased $500,000 in 1908. Meter, lamp and motor repairs were $18,000 lower in 1908. The item of globes was reduced in 1908, indicating the losing hold of the arc lamp in street illumination.

TABLE II.

Expenses of all Massachusetts Central Stations (private companies), 1908.

Coal or other fuel	$1,338,814.91
Rental of real estate used for plant	101,255.51
Oil and waste	35,577.68
Water	57,508.55
Wages at station	679,238.05
Station repairs	43,565.85
Steam plant repairs	135,695.75
Electric plant repairs	89,866.35
Apparatus and machinery	45,443.51
Energy bought	230,412.09
Wages of meter men, collectors, clerical labor	286,654.88
Repairs and renewals to lines	549,659.96
Repairs and renewals to meters, lamps, motors	140,621.23
Distribution tools and appliances	94,294.11
Carbons	68,966.56
Incandescent lamps	299,291.52
Globes	3,926.30
Directors' allowances	14,171.22
Salaries of officers	225,902.51
General salaries	430,156.20
Rent of offices, if separate from plant	29,013.25
General office expenses	258,259.42
Taxes	722,454.68
Insurance	149,696.27
Law expenses	61,134.19
Claims	3,417.93
Bad debts	38,930.10
Incidental expenses	11,671.22
Total	$6,145,599.80
Other Charges.	
Interest	$389,143.48
Dividends	2,019,933.50
Depreciation	299,182.11
Sundries	834,822.76
Total	$3,543,081.85

Low expenses and claims were exceedingly moderate, in comparison with the troubles which street-railway corporations sustain.

As a whole, these figures indicate that conditions in the Massachusetts central-station field are thoroughly satisfactory.

Technical Welfare Work.

By Sydney W. Ashe.

Three years ago the Edison Illuminating Company of Brooklyn instituted a series of lectures on electrical engineering for their employees, of which the writer was given charge. This idea has since developed into an exfensive system of educational work, now being carried on by the New York Edison Company, the Edison Illuminating Company of Boston, as well as its originator, the Edison Illuminating Company of Brooklyn. After three years' experience in this work it seems appropriate now to ask whether the undertaking has been a success, and if so, wherein have the various companies benefited. It is hardly necessary to go into the mechanics of this work as the details have been given from time to time in the various issues of the *Electrical World*.[1] The remarks of the writer will therefore be confined to the latter question. Increased loyalty of the men to their respective companies has been the first great benefit of this work. The personal interest of the various managements in their men has created a very kindly spirit and a feeling of pride in the home company. The men have felt that an effort was being made to raise their technical standard so that they could advance and in time occupy positions which now have to be filled by outside talent. The question may be asked as to whether the work would not in time serve to make the men discontented, whether they would not feel as they had attended all of the lectures in a season that they should immediately be promoted to general manager of the company. While it is true that a little knowledge is sometimes a dangerous thing, the results show that a little knowledge in this case has served more to whet the appetites of the men and make them realize their own limitations. They have become more earnest, more ambitious, more inquiring, less mechanical in their work, read the technical papers more, keep the librarians busy, have purchased many technical books and have kept themselves exceedingly busy.

The men have learned how to handle their apparatus in a more intelligent way, a slight mistake owing to ignorance of intelligent handling of apparatus often resulting in expense which would be far greater than the annual expense of the whole lecture course. In every lecture the particular points of danger in the handling of apparatus have been emphasized as most accidents are caused either by negligence or lack of realization of the full extent of the dangers which are always present, the possibilities of fatalities being thereby lessened. By having a better knowledge of things the men know better how to handle apparatus, and to locate trouble. As the time element is so important a factor in time of emergency in the lighting field, it is evident how very important is this characteristic of being able to analyze things quickly. Where such extensive educational opportunities exist the men are more contented and there is less of a tendency to shift to other companies, or, in other words, there is more of a spirit of "once an Edison man always an Edison man." The men also get a better idea of the whole of which they are a part.

These courses have usually been given in co-operation with the benefit associations of the various companies and have served to strengthen these associations, resulting in increased membership. For instance, in Boston a slight fee has been charged for the whole lecture course, as follows: $1 if the applicant is a member of the company and a member of the benefit association; $2 if he is a member of the company, but not a member of the benefit association, and $3 if he is not a regular employee, but a member of an affiliated wiring company. This method has increased somewhat the membership of the benefit association, has limited the attendance to those most interested, has served to flatten the attendance curve and has resulted in raising about $500 toward the expense of the course.

A very successful feature of this year's work in Brooklyn was the introduction of the supplementary talks given by the department heads and assistants at the lectures. These talks were limited to 20 minutes so as to relieve the department head of the burden and responsibility of preparing a lecture. The result of this system has been very gratifying, as it did much toward creating confidence in the men and also created a friendly competition between departments. It is rather interesting in this connection to note that the success of the meetings of the Brooklyn section of the National Electric Light Association has been due in no small measure to the co-operation of the men who gave the supplementary talks at the lectures. Fully two-thirds of the papers presented at these meetings and the discussions of these papers were owing to the men who had previously co-operated at the weekly lectures.

The enthusiasm of the lecture committee of the New York Edison Company was so great at the close of last year's course that they undertook to lay out and give this year an elaborate laboratory course in conjunction with the lectures. This course involved a very large amount of labor on the part of the lecture committee, but it has been quite successful.

The benefits of the educational work also extend to the lecturer in charge. He comes into close contact with men and with commercial practice and is very quickly relieved of the frills and hobbies that are too often characteristic of teachers. The success of each individual course requires careful planning, close study of conditions and human nature, the ability to keep creating something new, the keeping of close watch on new developments in the art and an immense amount of patience. Where the instructor is associated with a technical institution the same methods can be brought into the classroom. The result is wholesome and is what our technical institutions need.

Care must be taken with this work not to overdo it or its many benefits will quickly disappear. When with the meetings of various engineering societies and two or three evenings a week of educational work, it reaches a point where a man is at work each evening and feels that he is neglecting his duty if he does not keep up this pace, it is time to give the whole

[1] *Electrical World*, March 16, 1908.

matter a rest. However, this result can be avoided by limiting the educational work to one or two evenings per week, and then, if there are men who feel that they do not obtain sufficient benefit, they should be encouraged to attend some of the evening courses in our technical institutions.

The writer feels that the above work has done much to awaken the men and arouse their enthusiasm, has been a good asset for the various companies and has been a valuable experience for himself.

Automatic Thermo-Electric Control.

A patent was issued to Mr. H. Ward Leonard on March 23 relating to the automatic control of the energy supplied to an electrically heated tool. The patent states that if an electrically heated flatiron be used to iron damp goods as rapidly as possible, the iron becomes chilled, or if this difficulty be overcome by increasing the watts, then when the iron is idle it is likely to become destructively overheated. What is needed is a wide variation of the current, automatically controlled as needed to maintain a definite temperature irrespective of whether the iron is idle or is being worked to the limit.

The invention provides in the flatiron, in addition to the heating wire, an auxiliary controlling resistance of nickel or other material whose resistance responds immediately to a change of temperature. This change of resistance affects an exterior automatic, magnetically controlled switch in series with the controlling resistance, and the automatic switch, thus made responsive to a change in the temperature of the flatiron, is caused to vary the heating current as required. Thus in practice as soon as the iron is worked to the limit, this exterior automatic switch cuts out the exterior controlling resistance and causes the iron to take, say, three or four times as much energy as when it was idle. When the iron is set aside and tends to heat up under this very large working current, the automatic switch immediately inserts the resistance needed to prevent the iron from becoming overheated.

CURRENT NEWS AND NOTES.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION will hold its third annual convention at Oklahoma City, May 18-20, 1909. Mr. Galen Crow, Guthrie, is secretary.

TELEPHONE DIRECTORS' MEETING OPENED WITH PRAYER.—The Charles City Telephone Company, of Virginia, has its directors' meetings opened with prayer, a minister being summoned for that purpose.

ELECTRICAL MACHINE DESIGN.—At a meeting of the New York Electrical Society, to be held in the Engineering Societies Building, on April 29 at 8 p. m., Mr. B. A. Behrend will deliver an illustrated lecture on "The Design and Characteristics of Modern Electrical Machinery."

MRS. TAFT PURCHASES ELECTRIC VEHICLE.—Mrs. W. H. Taft, who is an enthusiastic automobilist, has purchased an electric vehicle which she will operate herself. It is stated that Mrs. Taft desired to operate one of the large White House gasoline cars, but that this wish did not meet with the approval of President Taft.

VIENNA TRACKLESS TROLLEY.—A consular report gives some details of a trackless trolley line in Vienna extending 1.37 miles through a narrow street with high grades, which was placed in operation last November. The line is double in order that the vehicles coming and going may pass without interruption. The total cost of the plant was $44,253, and it is estimated that the line will fall short of meeting expenses the first year.

JAPANESE LIGHT AND POWER STATISTICS.—According to a consular report the total electric-light and power-generating capacity in Japan at the end of 1908 was 86,606 kw, an increase of 12,090 kw over 1907. Of this capacity 54,550 kw was generated by steam, 31,951 kw by water-power and 105 kw by gas engines. Last year the Tokyo Electric Light Company began taking power from Katsura, 47 miles distant, the voltage being 55,000.

SORTING CIGARS BY TUNGSTEN LIGHT.—A new use for the tungsten incandescent lamp is pointed out in the daily-newspaper advertisements of the Commonwealth Edison Company, of Chicago. It takes keen eyesight to sort cigars at the factory into "dark," "medium" and "light," and hitherto, it is said, this work has been possible only by daylight. Recently sorting by the light of tungsten lamps has been tried, and it is declared that the experiment was entirely successful, thus demonstrating the color value of the light from tungsten lamps.

TELEGRAPH COMPANIES AND OPERATING IN "FUTURES."—A bill has been introduced in the Legislature of the State of Illinois to prevent the sale or attempted sale of breadstuffs or provisions not actually owned by the person selling or agreeing to sell. This measure is intended, evidently, to suppress gambling in "futures" on the Chicago Board of Trade. One feature of the proposed law is that telegraph and telephone companies are made liable to a fine of not less than $1,000 or more than $10,000 for transmitting messages to aid in the sales prohibited in the proposed law.

DOMESTIC FLAMING-ARC CARBONS.—In our issue of April 8 a note on the carbon tariff situation included the statement that there are no indications that the manufacture of flaming-arc carbons will be undertaken in this country. Later it was learned that the manufacture of this grade of carbons had been started by a certain factory, and in recurring to the subject in the following issue in connection with the Senate tariff bill, a statement in regard to the domestic manufacture of flaming-arc carbons was modified accordingly. We are now informed by another carbon manufacturing company that it has been making flaming-arc carbons for about a year.

GOVERNMENT TELEPHONY IN SASKATCHEWAN.—After many premature announcements the Saskatchewan Government has finally purchased the system of the Bell Telephone Company in that province. The price paid was $367,000 in cash and there is yet due the province some $10,000 in unearned rentals. The system consists of 469.4 miles of long-distance lines with 13 exchanges. The transfer will be made at midnight, April 30-May 1. This was the last mileage the Bell company owned in Canada between the Great Lakes and the Pacific Coast, and press dispatches state the Ontario Government will shortly consider the purchase of the company's system in that province.

NINE-HOUR LAW FOR TELEGRAPH OPERATORS UPHELD.—Judge K. M. Landis, of the United States District Court in Chicago, has upheld the "hours of labor" law and decided that the Atchison, Topeka & Santa Fé Railroad violated the law with respect to telegraph operators in a case brought before him. The Government charged the railroad with employing telegraph operators at Corwith, Ill., over a longer period than 9 hours out of the 24. While it is true the operators were only engaged for nine hours in actual work, they were employed in broken shifts of 12 hours each. The argument of the defense was that the law means that no operator should be on duty more than 9 hours in the 24, but Judge Landis was of the opinion that the meaning of the law is that an operator cannot be on duty for more than one period of nine hours and that this starts when he begins work and ends when he is finally dismissed for the day.

ELECTRIC LOCOMOTIVES AND FOREST RESERVATION.—Legislation has been introduced into the New Brunswick Parliament providing that all railways running through the timber reserves must be equipped solely with electric locomotives.

TELEPHONE MUNICIPAL OWNERSHIP.—The Manitoba Government Telephone Commission has issued a notice to the effect that in future linemen and cablemen will work 10 hours per day instead of 9 hours as previously. No advance in salary will be given excepting to those paid by the hour.

HEATING VALUE OF COAL.—The U. S. Geological Survey, Washington, has issued a bulletin giving the results of the Government's purchase of coal under the heat value specification. The editor, Mr. John Shober Burrows, the engineer in charge of this part of the fuel problem, sets forth the advantages of the method of purchasing fuel on the heat-unit basis, and shows how successful the method has been in buying fuel for the Government.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION.—The first quarterly meeting of the members of the Indiana Independent Telephone Association for district No. 2, composed of officials and managers, was held in Indianapolis, April 23. Questions of local interest were considered and delegates elected to the annual meeting at Indianapolis in May. Officers were elected as follows: Vice-president, Mr. Wm. L. Moellering; secretary and treasurer, Mr. Martin Umbalk.

WIRELESS IN JAPAN.—According to a consular report nearly all Japanese steamships on foreign lines are furnished with wireless telegraphy. In the navy all ships, from battleships down to torpedo-boat destroyers, are equipped with wireless telegraphy, and the wireless telephone was successfully used at the grand naval review off Kobe last autumn. The wireless telephone is being developed in the communication department and in the navy. The Teishinsho system of wireless telegraphy used has been developed in Japan and is stated to differ from the Marconi and De Forest systems.

CHICAGO-SOUTH BEND ELECTRIC RAILWAY.—The new Chicago, Lake Shore & South Bend Railway is being extensively advertised in the daily newspapers of Chicago. This railroad connects at Pullman with the Illinois Central Railroad, and six limited trains daily (except Sunday) leave Randolph Street, Chicago, for South Bend, Ind., 90 miles distant, which they reach in less than three hours. The new company says that it has the most modern and finest coaches ever put into service on any electric railway in the United States. Furthermore, it is declared that its trains make faster time than is made on any other electric railway in the world.

TELEPHONE RATES IN JAMESTOWN, N. Y.—The Home Telephone Company, of Jamestown, N. Y., by John H. Wright, general manager, has petitioned the Common Council of that city for authority to increase its rates. The present rates range from $14 per annum for the four-party line residence service, to $30 for single-line business service and are fixed by ordinance. The company petitions for a new schedule of rates ranging from $16 to $36 respectively. It is said that the cost of the plant was $286,015, while the net revenue for the year 1908 was only $14,415. Allowing 6 per cent interest on the cost of the plant and 3½ per cent for depreciation there would be a total fixed charge of $27,174. Deducting from this amount the net earnings would leave a net annual deficit of $12,758. The plant was constructed for a total capacity of 2000 subscribers' lines and there are now connected to it 2600 instruments, which has resulted in congested lines and impaired service; but to provide the extensions necessary the stockholders must be assured of a reasonable interest on the additional capital required. The Bell Telephone Company operating the same field is unrestricted as to rates. The present owners of the company are not the ones who originally built the plant. Mr. Wright says that the company "was organized on foreign capital and by men who had no previous knowledge of the telephone business, which, in a measure, accounts for the low rates agreed upon between the promoters and the city in granting the franchise."

PROPOSED RATE REDUCTION IN COLUMBUS, OHIO.—The committee of the Columbus, Ohio, City Council last week reported in favor of an ordinance which will make the maximum net rate for electric lighting in the city 6 cents per kw-hour. This action was taken in the face of protests from officers of the Columbus Railway & Light Company that energy cannot be furnished at that figure and that already there is a waiting list of about 1000 people to whom service cannot be furnished at the present rate of 7 cents, because the company cannot put in the connections and equipment at that rate. Vice-president E. K. Stewart stated after the meeting that the company cannot accept the proposed new ordinance and that it would not be legal for it to do so in the face of the fact that energy would have to be furnished at a loss to the stockholders.

FILIAL DEVOTION OF THE YOUNGER BIDWELL.—A rather pathetic sequel to the recent litigation in Chicago relating to the alleged "cold motor" of Benson Bidwell and his son, Charles E. Bidwell, has been made pubic. The Bidwells were recently convicted for operating a "confidence game" by promoting the sale of stock in a company to manufacture a "cold" electric motor for which fraudulent claims were made. The father, over 70 years of age, was sentenced to serve from 1 to 10 years in the penitentiary, but on the showing that he was a physical wreck and would probably die if subjected to long confinement, Judge Chetlain has vacated the original sentence and ordered the elder Bidwell to serve only 10 days in the county jail for petty larceny. This action was taken partly owing to the devotion of the son, who had an appeal pending staying the execution of his own sentence. In consideration of the leniency shown to his father, the younger Bidwell agreed to withdraw his own appeal, surrender his remaining rights and go forthwith to Joliet Penitentiary for an indeterminate sentence. This offer of a son to save a father was accepted on April 14.

BOYS INSPECT CHICAGO CENTRAL-STATION PLANTS.—One of the commendable enterprises undertaken by the Chicago Association of Commerce is an occasional excursion to industrial plants of interest in and near Chicago for sons of members. Thus the rising generation is shown in a very practical manner some of the principal props which underlie the commercial importance of Chicago. On April 17 there was an inspection trip of this character to the Quarry Street and Fisk Street generating plants of the Commonwealth Edison Company. About 340 youths and young men 14 years and over were included in the lively party. The boys were taken in special chartered street cars to the Quarry Street power house, and after viewing that they were ferried across the South Branch of the Chicago River to the Fisk Street plant, which was duly inspected in its turn. Luncheon was served in the boiler-room at Fisk Street and after a photograph had been taken of the merry "bunch" the boys dispersed to their homes. The party was in charge of Messrs. W. R. Humphrey, William A. Gibson, George E. Plumbe and William Hudson Harper for the Association of Commerce, and Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, did the honors for his company. The officials of the Association of Commerce were greatly pleased at the careful arrangements made for the reception of their boys and also for the hospitality shown by the Edison Company. It is safe to say that this aggregation of young men from families of influence will have a much better conception of the importance of the electrical service of Chicago than before taking this visit.

Central Heating and Lighting Plant for the United States Military Academy.

By Henry C. Meyer, Jr.

DURING the past few years Congress has appropriated $7,500,000 for the enlargement and improvement of the United States Military Academy at West Point, N. Y., made necessary by an increase in the Corps of Cadets. After an architectural competition had been held, Messrs. Cram, Goodhue & Ferguson, of Boston, Mass., were selected as the architects for the undertaking, with Messrs. Olmsted Brothers, of Brookline, Mass., associated with them in the landscape work. The general plans of the work were completed and many of the contracts awarded during the superintendency of Brig.-Gen. Albert L. Mills, whose successor, Col Hugh L. Scott, has since directed the preparation and approval of plans and the carrying on of the work.

The plans finally approved by the Secretary of War contemplated the erection of a new cadet headquarters, cadet barracks, hotel, academy building, administration building, chapel, bachelor officers' quarters, 35 officers' quarters, cavalry and artillery stables and barracks, quartermaster's storehouse, quarters for the superintendent and staff, riding hall, power house and other buildings of lesser importance.

While some at West Point seemed inclined toward a central plant for supplying steam as well as electricity to all of the buildings, this idea was abandoned as it was believed that all of the distributing steam pipes should be placed in tunnels of sufficient size to permit inspection and repairs to be made. As the buildings at the extreme north and south end of the post were separated by a distance of over two miles steam distribution through tunnels was out of the question. It was, therefore, decided to restrict the distribution of steam to the buildings bordering upon the parade and to those lying south of the parade as far as the hotel. The only large building not served would be the cavalry and artillery stables and barracks at the south end of the post, the quartermaster's stores and other smaller buildings to the north, and these will be taken care of by separate plants.

The consulting engineer was instructed to design a plant capable of supplying sufficient steam to warm and ventilate the large buildings of the central group then proposed and of furnishing electricity for all purposes for the entire post; to construct a power house of sufficient size to permit the installation of such boilers and electrical generating apparatus to take care of the demands should the Corps of Cadets be increased to 1200, and to provide storage capacity in the power plant for 4500 tons of anthracite coal. This was desired so that coal could be delivered when the Hudson River is opened to navigation and at a time when freezing weather would not interfere with coal handling. So large a storage capacity also reduced the opportunity for strikes to affect the operation of the plant. A study of the situation, based upon the plans for buildings then proposed, seemed to indicate that about 3000 hp would be required for warming and ventilating the buildings and supplying hot water for bathing purposes, with a possible increase of 600 hp required by the increase in the corps mentioned. The probable maximum electrical load seemed to be about 1200 kw for the buildings immediately contemplated and about 200 kw additional for the increase.

After considering a number of possible sites, it was finally

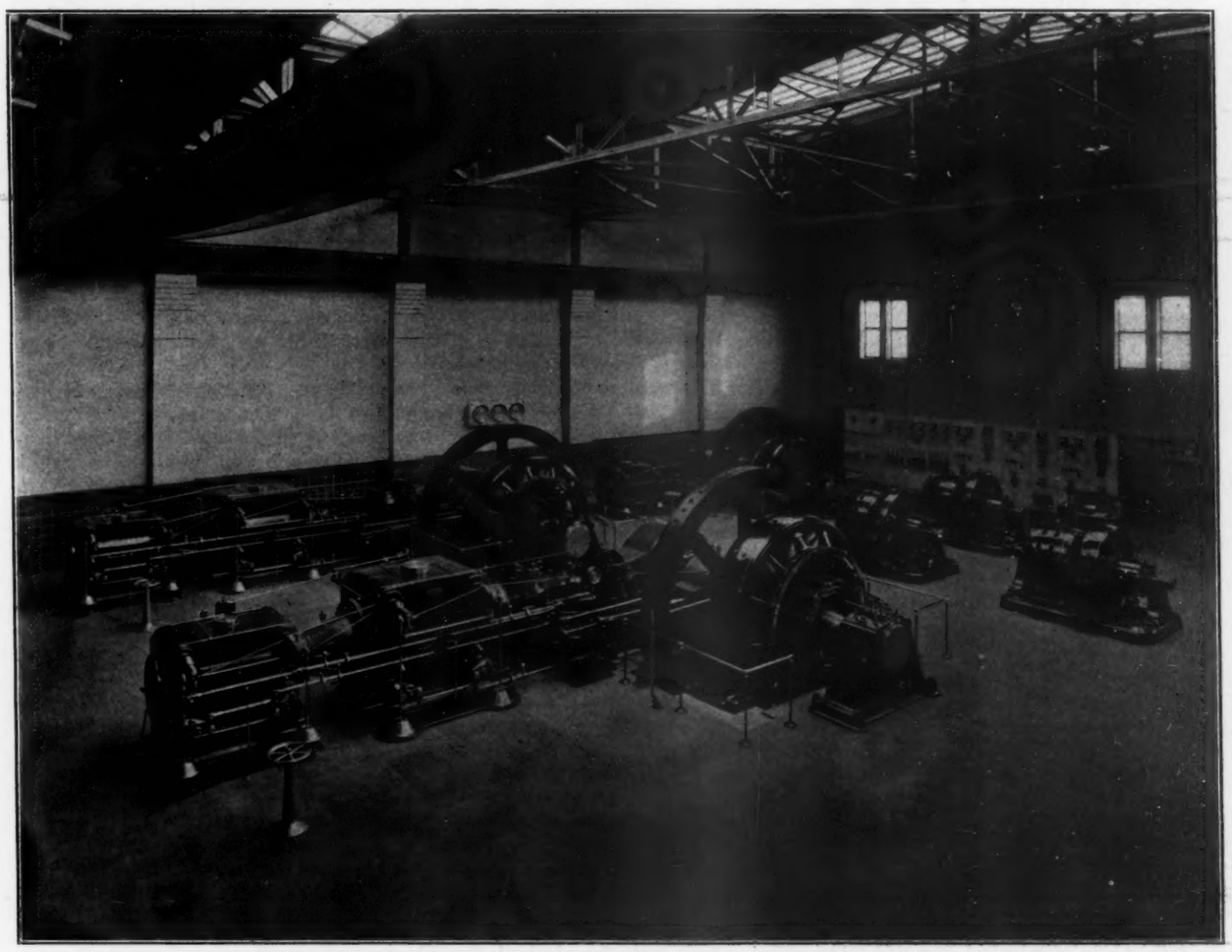


FIG. 1.—GENERATOR-ROOM IN POWER PLANT AT WEST POINT MILITARY ACADEMY.

decided to blast out a pocket in the rocks over the southern entrance to the railroad tunnel and there locate the power house; to conceal the chimney in the tower of a riding hall soon to be built, and to provide means for the mechanical handling of coal either from rail or water delivery, and for the disposal of ashes in a manner that would not be objectionable in so prominent a location. The natural contour of the rock at the site selected, and the desire to depress the roof line of the building so as not to cut off the view of the imposing south front of the riding hall, led to the adoption of a somewhat unusual arrangement of the building. Rock was found at a short distance below the grade at the railroad siding of such a character as properly to support a masonry structure on which it was intended to run the cars for the delivery of coal. This same structure carries a tower for the storage of ashes. The boiler house extends north and south, and contains a boiler-room on the main floor, with basement extending under the front of the boiler-room only. The coal bunker above is a large box-like structure 148 ft. long, 57 ft. wide between column centers and about 21 ft. 6 in. deep on the clear. A tower on one of the corners of the boiler-room contains the elevator for raising coal, and this tower is connected to the ash tower by two masonry walls roofed over to form an enclosure for the belt that conveys the coal from the cars up a steep incline to the base of the elevator. The engine-room has a basement beneath and a tower at the corner of the room provides the principal means of access between the engine and boiler-rooms, also space for the chief engineer's office, and locker and bath-rooms for the operating force.

The building is faced with natural rock quarried at West Point and arranged as random-coursed ashlar and the style is Gothic to harmonize with the other buildings. The coal bunker, roof trusses and floor systems are carried on steel columns resting on heavy cast-iron bases, and the outer walls do not carry any load other than their own weight. As the coal bunker was planned to contain 4500 tons of coal, the design of the steel work was somewhat out of the ordinary, particularly as each interior column had to carry part of the weight of the boilers. The maximum load on any column was 304 tons. The floor of the bunker consisted of heavy steel beams framed into the girders and supporting a concrete floor of varying thickness and laid so as to drain to the middle point of each bay. On account of the heat given off by the boilers expansion joints were provided for in the beam and girder construction, and the concrete floor was laid in squares the size of the bays with an open joint between, which was afterward filled with oakum and pitch. The side and end walls of the bunker consisted of beams framed into girders at the top and bottom with concrete walls laid between. The plans for the steel work were prepared by Joseph H. Wallace & Company. The engine-room has a floor of Welsh quarry tile, which is dark red in color and non-absorbent. The side walls have a wainscot about 5 ft. high of a very dark-green Rookwood tile. Above is the face brick, which is Kittanning non-absorbent and a light buff in color. The roof trusses and traveling crane are painted a dark green and the color scheme is very pleasing.

BOILERS.

The boiler plant at the present time contains four Babcock & Wilcox boilers, each containing about 4400 ft. of heating surface with tubes arranged 21 sections wide and 10 tubes high. The boilers are of the usual forged-steel construction. The grates are of the Treadkill type, with 87 ft. under each boiler, giving a ratio of heating to grate surface of 50 to 1, an unusual one with small-size anthracite coal, but permissible in this case as mechanical draft is available when needed. The boilers are suspended by straps around the drums from horizontal channels carried by the building columns and the spacing of the columns is such that two columns are located between each battery of two boilers requiring that the boilers in each battery be spaced sufficiently to prevent the heat of the furnace from affecting the columns. To save space the usual 17-in. side wall was reduced to 13 in. opposite the column and vertical cast-iron channels bolted to the wall to secure an air space. The spaces in front of the columns and between the settings were closed by iron plates secured to the flanges of the channel and the bull-nosed brick laid to finish against the plate and thus present a proper appearance. The feed pipe is on the level of the boiler drums, and the feed valve has an extension spindle extending to the wheel-hand high above the boiler-room floor.

The chimney, which will be later inclosed by the tower of the riding hall, is of the Custodis radial-brick type with an inner core 10 ft. inside diameter at the top and 140 ft. above the grates. The chimney contains an inside ladder, also lightning rods connected by a copper cable with an extension run down to the river and there connected to a submerged copper plate. As the free exhaust from the engines at the power-house roof would be objectionable, it is discharged at the top of the chimney through a 16-in. cast-iron flanged pipe run up inside of the chimney and stayed to it in such a manner that the pipe can expand easily. As the chimney was limited in height by architectural considerations, and is not high enough to obtain sufficient draft to burn low-grade coal to run the boilers at their rating, a mechanical-draft plant was installed. The plant consists of two Sturtevant fans and engines, each fan furnishing 55,000 cu. ft. of air per minute at a pressure of 2½ in. of water. Both blowers and engines are located on a mezzanine floor, and each blower discharges downward through an iron duct into a masonry duct below the boiler-room floor level and extending across the boilers in the rear of the bridge wall. Connections lead to the ash pit, and they have the usual dampers operated by levers extending through the fronts of the boilers. The fans are controlled by a Foster regulator actuated by the boiler pressure.

Each boiler is connected by a smoke connection of steel plate put together with angles to the bottom of the main smoke flue, which is supported by beams from the building columns. The flue has a concrete floor, brick side walls and double rowlock brick arches sprung between transverse I-beams for a top. Expansion joints are provided in the flue. The smoke flue is provided with a pair of dampers close to the chimney. They are of cast iron heavily ribbed and suspended from the steel floor-beams of the coal bunker by several links of a chain with a turnbuckle for vertical adjustment, the chain tending to make them operate more easily. The damper is fitted with a Locke damper regulator. This is not used when the fans are in operation.

COAL AND ASH HANDLING.

Means are only provided at the present time for the mechanical handling of coal delivered by rail, but the system is designed with the idea of taking care of coal by water at any time that it might be desired so to receive it. As the facilities for switching cars at West Point are somewhat limited it was decided to arrange for the unloading of four 50-ton hopper-bottom cars without shifting and two tracks were arranged for so that two cars could be run in on each side of a belt conveyor, and slightly above it, so that a gravity discharge could be obtained through chutes onto the belt. Two of the cars can be run under the large tower and there is space for two others outside of the tower. The belt runs from beneath the unloading platform upward at an angle of about 23 deg. to the base of the tower at the southeast corner of the building, and there discharges into the boot of an elevator which raises the coal to a point above the top of the bunker. The coal is then spouted onto a transverse belt conveyor extending across the south end of the boiler house. This discharges into a bunker below or onto either one of two longitudinal belts, which deliver through automatic trippers into any part of the bunker beneath them. The first conveyor and the transverse conveyor are each 18 in. in width and the longitudinal conveyors are each 16 in. wide. The specifications required that the system handle 60 tons of 2240 lb. each per hour. The conveyor has upon test considerably exceeded this requirement. The elevator buckets are connected by a two-stand, drop-forged chain with malleable-iron bucket attachment with heavy steel pins. The elevator is enclosed in a casing of heavy steel

plates put together with angles at all corners and joints. To prevent the elevator from falling and jamming in case of breakage, the pins are extended into a channel on the inside of the casing made of a pair of angles. The conveying system is operated by three Westinghouse motors, one driving the lower conveyor, one driving the elevator and the transverse conveyor and one driving the two longitudinal conveyors. The motors are of the enclosed type, and the starting boxes are enclosed in dust-proof iron boxes. An electrical connection is run from each starting box inside of the switch to a pilot lamp on a

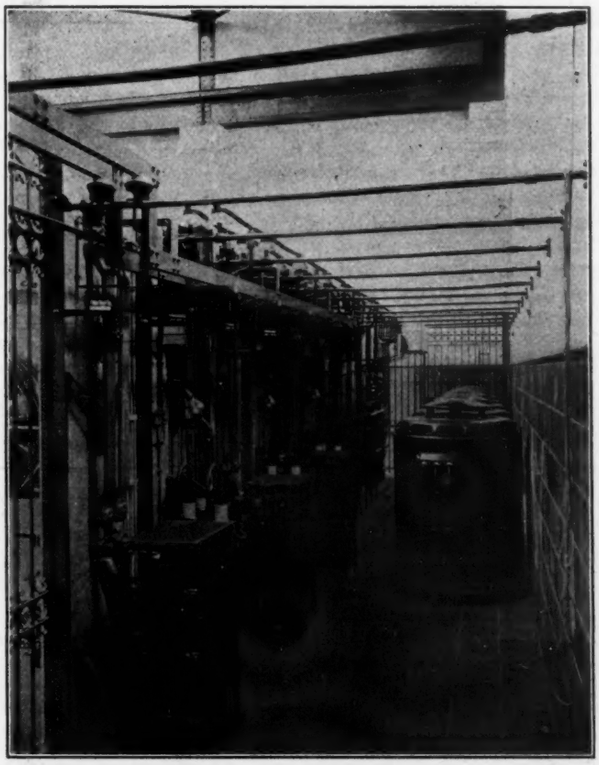


FIG. 2.—REAR VIEW OF ALTERNATING-CURRENT SWITCHBOARD.

board in the boiler-room. This board also contains an automatic circuit-breaker in the main feed supplying all of the motors. The solenoid of the breaker is connected by wires to push buttons at various parts of the conveying system so that an attendant can, by pushing a button, stop the operation of the entire coal-handling plant when necessary. The motion of the shaking chutes regulating the delivery of coal from any car to the lower belt is controlled by a wheel on a shaft extending up through the platform on which the cars are located. The conveying system was supplied by the Robbins Conveying Belt Company.

Coal is discharged from the bunkers to the boiler-room floor by numerous chutes at points convenient for firing. As the bottom of the coal-bunker floor is flat, to give maximum storage capacity, similar chutes are provided at the rear of the boilers and arranged to dump into Hunt standard charging cars so that the coal may be carried on tracks to the front of the boilers. The chutes have a valve at the bottom and also a sliding gate just below the bunker-room floor level.

The ash pits have a deep hopper bottom so arranged with chutes that the ashes may be drawn out into industrial cars and run through the boiler-room basement and on the roof of the conveyor incline over an ash hopper that will be constructed at a later date in the upper part of the tower so that ashes may be discharged into railroad cars for removal. At the present time the ashes are being used for filling in and are being discharged through a temporary opening in the side wall of the power house.

ENGINES.

The conditions existing led to the adoption of direct current at 240 volts for both lamps and motors and for alternating current at 2200 volts for the extreme north and south end of the post. It was decided to install at the present time two 400-kw and one 200-kw direct-current generators, each of the former driven by a tandem-compound Corliss engine and the latter by a simple Corliss engine. Motor-generators are used to obtain the alternating current. As part of the exhaust steam from the engines could be used for heating during the winter months and as the river is 60 ft. below the engine-room level, the use of condensers was not considered advisable. The Providence Engineering Works were awarded the contract for the engines. The specifications called for a normal working pressure of 130 lb. at the throttle, but which might be increased to 150 lb. when considerable back-pressure was placed upon the engines during the heating season. The speed was limited to 100 r.p.m., and the engines were to be capable of running at 50 per cent overload for short intervals. The compound engines are each provided with a large reheating receiver containing 0.6 sq. ft. of reheating surface in brass pipes per rated horsepower of the engine. The simple engine has its cylinder steam jacketed in both heads only and the compound engines have high- and low-pressure cylinders jacketed in a similar manner. All of the engine piping is below the engine-room floor and the main throttle valve and the valve in the exhaust pipe are operated by floor stands. After erection the engines were subjected to a rigid test by Mr. George H. Barrus. The

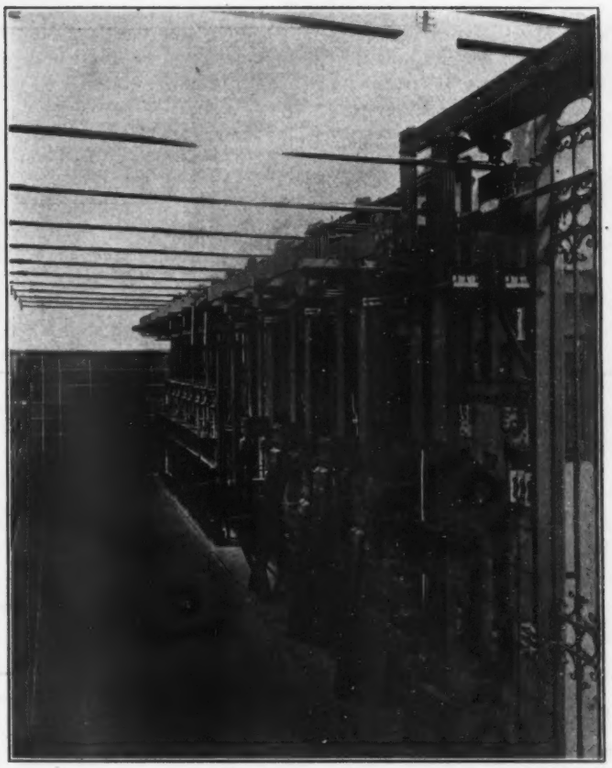


FIG. 3.—REAR OF DIRECT-CURRENT SWITCHBOARD.

builders guaranteed that the steam consumption of each compound engine would not exceed 19 lb. of steam per ihp with a steam pressure of not less than 130 lb. at the throttle and 1 lb. back-pressure in the exhaust pipe. The friction load of each compound engine was guaranteed not to exceed 4½ per cent of the rated load, taken at 600 hp. The steam consumption of the simple engine was not to exceed 23 lb. per ihp per hour when the engine is developing from 275 hp to 325 hp with a steam pressure not less than 130 lb. at the throttle valve and 1 lb. back-pressure at the exhaust valve. The friction load of

the simple engine was not to exceed 4½ per cent of the rated load, taken at 300 hp.

The tests showed that the steam consumption of the compound engine was 3.5 per cent better than the guarantee and the simple engine 8.8 per cent better, and that the friction of the compound engine and simple engine was within the limit guaranteed.

PIPING.

The piping in the power house consists of a system of pipes conveying steam to the engines and pumps and also to the high-pressure line run through tunnels to the various buildings. The exhaust steam from all engines and pumps is run through a grease extractor and pipes are provided for conveying exhaust steam for warming buildings adjacent to the power house, the exhaust steam being carried as far as the Academy Building. Means are provided for supplementing the exhaust steam by live steam direct from the boilers through reducing valves and reducing valves are also used to lower the steam pressure on the direct lines of the buildings from the usual boiler pressure of 135 lb. to from 80 lb. to 100 lb. for the tunnel system. Fig. 2 shows the arrangement of the piping in the power house. During the heating season the exhaust steam passes through the 16-in. line through the basement of the engine-room to the entrance of the steam tunnel and as it rises to the tunnel, connection is made with the high-pressure lines which supply steam direct from the boilers through Foster reducing valves to supplement the exhaust steam when it is insufficient in quantity to warm the buildings connected to the exhaust heating system. All points at which steam might collect in the high-pressure system, the reheating receivers on the compound engines and the steam jackets on engine cylinders, the separators and steam-supply pipes are all connected to the Holly gravity-return system. The condensation that occurs in the various buildings connected to the central plant is returned to the power house by Bundy pumping traps. The feed-water pumps are of Worthington manufacture and the heater is of the Wainwright type.

All high-pressure steam pipes in the power house and in the tunnel system 2 in. in diameter and over are provided with extra heavy flanged fittings and with extra heavy flanges for connecting the piping. In all of this piping, 5 in. in diameter and over, the Rockwood type of joint, sometimes called the Van Stone joint, with rolled-steel flanges, made by the Latrobe Steel Company, is used. All of this work and the pipe bends were manufactured by the M. W. Kellogg Company for the Thompson-Starrett Company, which firm had the contract for all piping work in the power house and tunnels.

ELECTRICAL EQUIPMENT.

A preliminary load curve that was constructed, based upon the size and probable use of electricity for lamps, motors, etc., was similar in character to that in a city-lighting plant, but with a smaller demand for current. While the greater portion of the load consists of lamps, a considerable number of elevators are to be used in the buildings comprising the central group, all of which are located within a short distance of the power house. The Cadet Mess Hall contains a most elaborately equipped kitchen and bake shop, and a large number of motors are used for dish-washing, bread-making, food preparing and other purposes. The large building that will be erected for the Quartermaster's Department will be fitted with all kinds of machinery, which is to be electrically driven by motors, in many instances of variable speed.

Practically all of the buildings on the grounds requiring energy for motors are within 2700 ft. of the power-house site. The large group of buildings at the south end of the grounds, about 8000 ft. from the power house, comprising the cavalry and artillery barracks, had an estimated wired load of 75 kw in incandescent lamps. The Soldiers' Hospital is located at the extreme north end of the reservation, and it is intended to erect at this point a large group of small houses for soldiers. All of these buildings, as well as the various groups of officers' quarters, require energy for lamps only.

Before a decision was reached as to the kind of distributing system best suited to the conditions, five systems were considered. The difficulty of obtaining a balance in a three-wire system and the desire to use direct current as far as it could be used with economy, led finally to the adoption of a 250-volt, two-wire system, and it was found that this could be used to supply energy to about 75 per cent of the total expected load without great expense. To take care of the balance and to supply street lighting it was decided to use motor-generators delivering 60-cycle, single-phase current at 2200 volts to supply energy to buildings at the extreme north and south ends of the grounds and for supplying the series street-lighting system through tub transformers.

The load curve indicated that the maximum lighting load for the buildings supplied with direct current amounted to 925 kw for lamps and 100 kw for motors, with a maximum of 250 kw for alternating-current lighting with 90 kw for series street lighting. All of the projected buildings have not yet been completed. At the present time there is installed two 400-kw and one 200-kw generators, the former driven by tandem-compound Corliss engines and the latter by a simple Corliss engine, all made by the Providence Engineering Works. The normal full-load voltage of all generators is 250 volts, but means are provided for varying the voltage within reasonable limits. Each generator was designed to over-compound 10 volts from no load to full load to compensate for the drop in the feeder system, but this may be reduced to various lesser amounts of over-compounding by means of a special series field shunt.

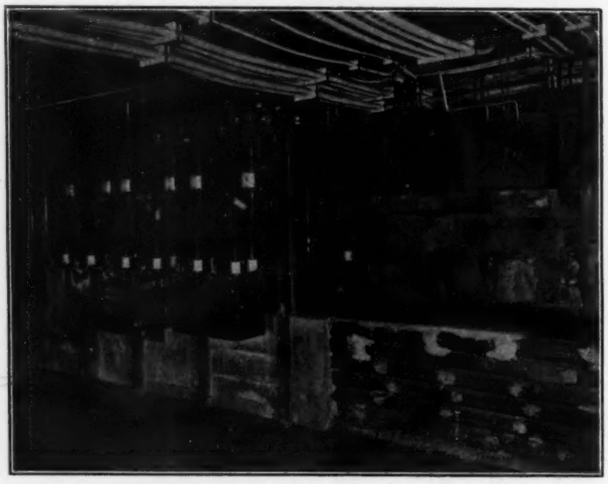


FIG. 4.—SWITCHES AND CONTROLLERS IN BASEMENT UNDER SWITCHBOARD.

Three motor-generator sets have been installed. The generators have a normal load of 125 kw with a single-phase, alternating e.m.f. of 2400 volts at a speed of 600 r.p.m. Means are provided for varying the fields of the motors should the speed tend to change due to any change in the direct-current e.m.f. The motor-generators are, of course, arranged to operate in parallel. All electrical apparatus in the power house was supplied by the General Electric Company.

The generators and motors are connected to the switchboard by fireproofed rubber-covered cables hung in porcelain insulator racks supported from the basement ceiling. The alternating- and direct-current sections of the switchboard are separated by a wrought-iron grille. The direct-current buses extend from the generator panels to the right through a direct-current station panel to the feeder panels, and to the left through an alternating-current station panel to the motor-generator panels. The 2200-volt, alternating-current feeder panels are to the left of the motor-generator panels with the series street lighting panels on the extreme left. The 2200-volt feeder buses and oil switches with transformers are located in the basement directly under the board. Whenever it is necessary to add another pair of motor-generator panels or

another direct-current generator panel it can be done by removing as much of the iron grille as is necessary, the grille being so constructed that one, two or three panels may be added and still place the doorway midway between the sections of the board.

The direct-current distributing system comprises an extensive system of feeders, the outer terminals of the feeders being looped together by mains, and it is the intention to keep the mains at approximately constant voltage throughout their length. Pressure wires are run back to the power house from the junctions of feeders and mains and a sliding voltmeter

21 panels of a total length of about 67 ft. The generator panels contain double-pole main switches, field switches, voltmeter switch, single-pole circuit-breaker, ammeter and rheostat wheel. A pilot lamp is placed on each board and this is wired on the generator leads inside of the main switch and circuit-breaker so that there will be light on the board when the generator is running even though the circuit-breaker might open.

The direct-current station panel contains two station-type voltmeters on a swinging bracket, one station ammeter and two kw-hour meters, one for the high and one for the low-voltage bus. The two voltmeters on this panel are connected to

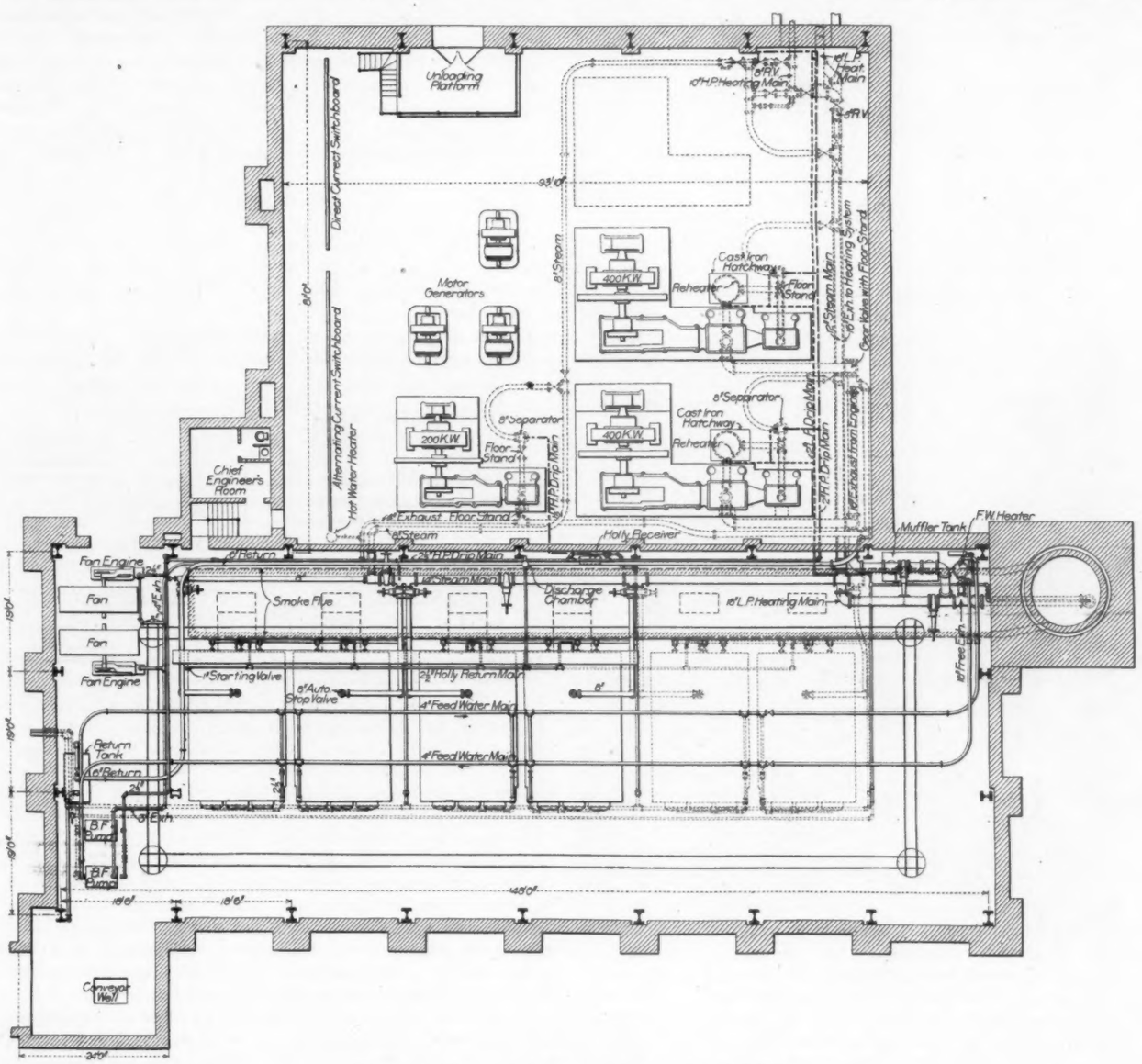


FIG. 5.—PLAN VIEW OF GENERATOR AND BOILER-ROOMS.

switch is provided on the station desk for reading the voltage at the junctions. There is a double set of positive feeder buses with a negative feeder bus. The positive leg of each feed, being connected to the middle point of a single-pole, double-throw switch, may be thrown on to either positive bus as required. By means of this arrangement and double-throw, generator main switches the generators may be run at slightly different voltages, one connected to the high-voltage and the other to the low-voltage bus, and each feeder may be thrown on the high-voltage or the low-voltage bus, as may be desired, in order to maintain equality of voltage at the mains and to compensate for unequal drop in different feeders.

The switchboard is of blue Vermont marble and consists of

the pressure wires in two feeders, one running to a nearby junction and one to a remote junction so the switchboard operator may see at a glance if equality of voltage in the mains is being maintained.

The direct-current feeder panels contain the double-throw switches and an ammeter in one leg of each feeder. Each leg of each feeder connects to the board through a composition open-link fuse of sufficient capacity to open only when the feeder is dangerously overloaded, and then only when the overload is of a continuous nature. These fuses are mounted on a soapstone slab supported free from the board and protected with flame guards.

The alternating-current station panel contains a differential

galvanometer and one station-type voltmeter, both on a swinging bracket, either being used in paralleling the generators. There are also rotary switches for the station galvanometer and voltmeter and a double-pole plug voltmeter switch for connecting the bus coil of the galvanometer to either the positive high-voltage bus or the positive low-voltage bus. The energy for the motor-generator and the station lamps, which are controlled from the station panel, is recorded by a kw-hour meter on this panel.

The motor section of the motor-generator panels contains a double-pole circuit-breaker interlocked with the corresponding alternating-current generator switch, field-circuit ammeter, main switch, starting rheostat with a five-stop multiple-interlocked starting switch with no voltage release, while the generator section contains voltmeter, ammeter, a frequency indicator, a field-switch rheostat and combined single-phase oil switch and automatic circuit-breaker with auxiliary tripping coil operated by the motor circuit-breaker. The generators are paralleled by a synchronizing lamp and by a voltmeter connected across the lamp terminals. The feeder panels contain ammeters, plug switches for ground detector readings, and the operating mechanism of the combined oil switches and circuit-breakers. The street-lighting panels contain an ammeter and ammeter jack, and plug switches for each circuit. Explosive high-tension fuses are placed behind the board in each circuit.

The system of distribution is by an underground cable system with rubber-insulated, lead-covered cables manufactured by the Okonite Company. The work of drawing in the cables was done by Messrs. Johnston Livingston, Jr., & Company, under the direction of the cable makers, who also furnished splicers for the work.

All direct-current cables are single-conductor, lead covered; all alternating-current cables, except transformer leads, are of the duplex type in a single lead sheath. Each leg of a direct-current feeder was made up with two potential leads or pressure wires in the outer layer of strands, each pressure wire being No. 15 covered with an insulating wall of such a thickness that the space occupied by each lead with its insulation is equal to the space occupied by a single strand of the cable. One of the leads in each cable is used as a testing lead when necessary or in case of breakdown of the other lead.

At the present time 11 direct-current feeders have been installed and each leg terminates in a water-tight junction box in a manhole, where connection is made to the corresponding leg of the main and to such buildings as may be served from the manhole. The positive and negative are separate throughout, there being separate positive and negative junction boxes. A drawing of a typical box is given. These were made in four standard sizes with connections for three, five, seven and nine cables. The boxes were designed especially for this work and are believed to possess some points of interest, one being the comparatively small amount of space required inside of the box. The cables enter through water-tight stuffing boxes, the stuffing boxes being made to answer for any size of cable by means of a brass ring and a brass gland, each of which has a hole the proper size for the cable that is to pass through it. The ring acts as a seat for the packing beneath the gland. The entering cable terminates in a flat lug which is bolted to one end of a copper block, to the other end of which a composition link fuse is bolted and serves as a connection between the feeder terminals and the box bus. The bus is mounted on a soapstone seat and composition link fuses serve to make connection between the bus and the copper blocks to which the main and house branch terminals are bolted in a manner similar to the connection at the feeder block. The pressure wires are connected to the bus through a plug fuse cut-out. The junction boxes are provided with rubber gaskets and heavy bronze nuts and bolts for securing the cover in place. The junction boxes were made by Messrs. Russell & Stoll, of New York, in accordance with the writer's specifications.

The alternating-current house-lighting system consists of 2200-volt, duplex conductors connecting through single-pole cut-outs to transformers located in a few instances in manholes and in most cases in vaults forming part of the buildings supplied. In the case of the different groups of officers' quarters, one transformer serves a number of buildings. The greater portion of the secondary distribution consists of a 120-240-volt, three-wire system and in the case of the officers' quarters, which are small residences, a three-wire service is brought into each building to a three-pole cut-out and the two-wire distribution in the different quarters are connected alternately to the different sides of the three-wire main so as to obtain proper balance.

The alternating-current junction boxes are also waterproof and are of usual construction. They are of the single-pole type provided with enclosed fuses and they are equipped with water-tight stuffing boxes with a brass nozzle for the entering cable, the lead sheath of the cable being wiped to the nozzle. Alternating-current junction boxes are used as transformer cut-outs only. The secondary transformer leads are wiped directly to the low-tension mains. The service connections to buildings are wiped directly to the low-tension mains, where there are any, or to the transformer secondary leads in the absence of mains.

Cut-outs are placed on all service connections inside of each building at a point close to where the wires enter the building. The cut-outs are of the Sachs type and contain fuses that are disconnected by opening the box cover. These cut-outs are used for the direct-current work and for most of the alternating-current distribution.

During the erection of the power house the tungsten lamp made its appearance and as the prospect of its success seemed

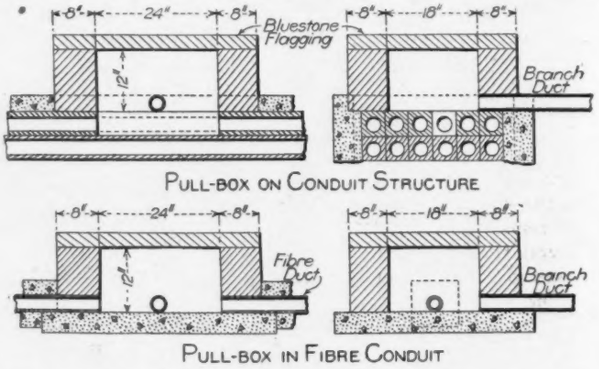


FIG. 6.—DETAILS OF DISTRIBUTION BOXES.

to be assured, arrangements were made in the cable contract and in the wiring of buildings supplied with direct current for changing over to a 120-240 three-wire system, in case such a change seemed advisable. For this reason three-pole service cut-outs were installed. If this change is ever made a single-conductor, neutral main may be pulled into the conduit system to which neutral leads from the various buildings may be connected. The system is so arranged that a few neutral conductors will have to be run from this neutral main to the power house, where a single neutral feeder panel can be installed together with the necessary operating panel for balancers.

When the question of street lighting was first considered the several methods then in general use were discussed and various forms of lamp-posts for both arc and incandescent lamps were examined. The board of officers to whom the matter was referred objected to the use of arc lamps at the Military Academy, and when the usual form of incandescent lamp-post was shown to the architects, the objection was made that any lamp-post bearing a resemblance to a shepherd's crook was entirely out of place at a school for training soldiers. The architects were very desirous of using the old-fashioned lantern of Gothic design with iron corners and top. The writer held that the lamp should be supported in a pendant position and the iron top was designed to take the same type of lamp holder and socket that is used for series incandescent work. The holder is screwed into a tapped casting in the upper part of the lantern and the lamp-socket slips into the holder and is held by means of the usual contact clips. The cables pass up

through the post and divide upon entering the lantern, continuing up in diagonal corners of the lantern and connecting to the terminals on the lamp-holder. As the cables have an insulating wall of 6/32 in. thick and this is covered with a triple layer of braid, care had to be taken in concealing the cable and designing the parts of the post so that the cable could be easily pulled in and connected. It would have been practically impossible to have used this lamp-post without ground glass in the lantern, the use of which was suggested to the writer by Mr. V. R. Lansingh. With plain glass, which was tried, the broad black shadows cast by the four iron corners of the lantern and by the base made the lighting very unsatisfactory. With ground glass, however, the shadows, even those around the base of the lamp-post, entirely disappeared. A further advantage of the ground glass lies in the fact that the high intrinsic brilliancy of the filament is entirely avoided.

SUBWAY SYSTEM.

The distribution of electricity is entirely by an underground subway system consisting mainly of single clay ducts with brick manholes, with branches from manholes to buildings and from manholes to street lamp-posts when the post is near enough to the manhole to make this method advisable. Where lamp-posts, along the line of the clay duct subways, are not close to manholes, a pull box, as shown in Fig. 6, was constructed. One duct in the upper layer of ducts opens into the pull box and a branch connection of fiber is run to the base of the lamp-post. In streets or roads through which the main subway does not extend the street lamps are fed from cables run through a single-fiber duct laid in a concrete envelope with pull boxes opposite the lamp-posts. Some of the roads are bounded on the east side with stone walls and in some instances the street lamps are located upon the walls. The cables for posts so located are run in wrought-iron pipe hung beneath the projection of the wall coping on the east or far side of the wall so as to be invisible. The conduit sections for this work terminated in cast-iron pull boxes set in the wall with door and branch conduit extending into the base of the post. The total amount of clay conduit installed was about 85,000 duct-feet with 83 manholes and 142 pull boxes.

The contract was a flexible one in that it called for unit prices per foot of conduit for various numbers of ducts; for unit prices on different types of manholes; for excavation in earth to various depths; for excavation in rock; for brickwork, concrete and manhole covers, so that there could be changes in location and reasonable changes in quantities as the work progressed without affecting the unit prices bid.

The ducts were 3-in. standard clay conduit laid in cement mortar with a concrete envelope on the top, bottom and sides, with the top not less than 2 ft. 6 in. below the surface. All manholes are drained by a hole in the floor covered with a perforated iron plate. The manholes are in most cases either connected to the sewer or in cases where the slope of the ground permitted by a drain run to the surface. Great care was taken to lay the ducts so that the conduit sections are without pockets and drain toward the manholes. Grade stakes were used except where the pitch was so sharp as not to require them.

The fiber ducts for the street lighting were 2½ in. American conduit laid on a bed of concrete and afterward enclosed on the top and sides with a concrete envelope not less than 2 in. thick. Mr. P. H. Porcheron acted as inspector of the work for the Government and the Russell Contracting Company, of New York, was the contractor. The writer, who was appointed by the War Department as consulting engineer of the power plant, street illumination and steam distribution, wishes to acknowledge his indebtedness to Mr. Philip Torchio, to Mr. Geo. A. Orrok and to Mr. J. D. Whittlesey for many valuable suggestions during the preparation of plans for the work; also to the writer's assistants in the work of preparing plans and specifications, especially to Mr. Bassett Jones, Jr., on electrical work, to Mr. K. A. Nylen on piping and steam engineering, and to Mr. J. J. Ruckes for the power house, tunnel and other work.

Effect of a Severe Sleet Storm in the Mohawk Valley.

On Feb. 18 the central part of New York was visited by a severe sleet storm which swept down the Mohawk Valley. There were no signs of the storm at Syracuse; but farther east, at Canastota, the northeastern portion of the upper petticoat of the high-tension insulators on the transmission lines appeared to be covered with sleet, although the wires themselves were singularly free. Between Canastota and Utica the sleet was heavy and many trees had limbs broken and some telephone wires were down. In Utica the wires were covered with a thin film of ice, but no great damage was reported. In the little town of Frankfort the telephone wires were all heavily coated and sagged to a depth of 8 ft. to 10 ft. on 100-ft. spans; and between the town and Ilion the telephone wires were down in several places. Some of the wires that were still on the poles were badly stretched and short-circuited. The sleet

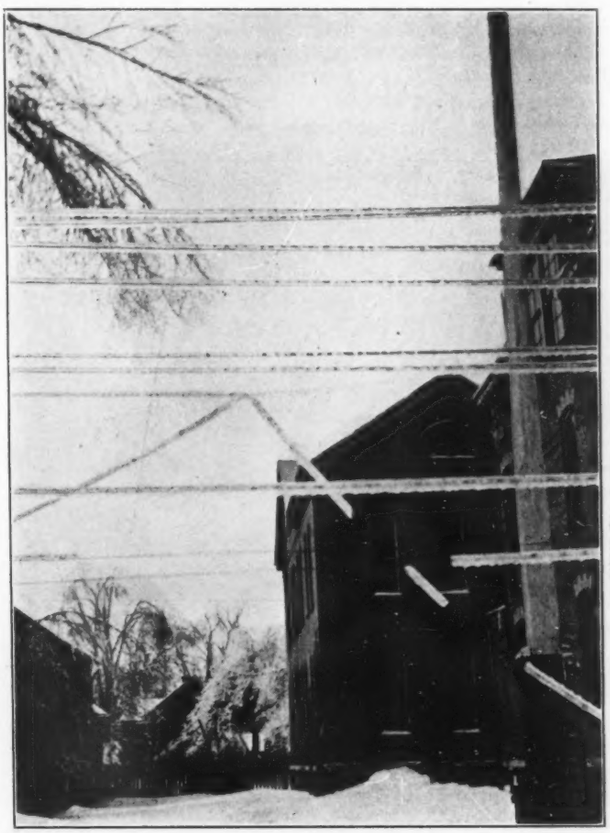


FIG. 1.—TELEPHONE WIRES COVERED WITH SLEET.

had not broken or fallen from the wires, although a 20-mile wind was blowing all morning. As might have been expected, the trolley wires did not appear to have suffered much injury.

Between Ilion and Herkimer conditions were very bad. Cross-arms were broken, pole tops were snapped off and the wires stripped completely between the poles that were left standing. In the city of Herkimer there was scarcely a tree without some broken limbs. The streets were covered with limbs and a mass of wires. Men and teams were kept busy clearing the wreckage, and nearly all the wires of both telephone companies and the electric light company were put out of service. At about 10 o'clock the temperature began to rise and this, with the action of the wind, caused much of the sleet to fall. There were many instances of the tenacity with which sleet hangs to the wires; the best of these was probably shown by the mass of wires hanging loose from the cross-arms of the poles. These had probably fallen 35 ft. or 40 ft. and yet the

sleet had not been broken on the wires. The Independent Telephone Company's wires were almost totally destroyed. Its poles, being still rather new, were left standing, but the wires were stripped from them. The Bell Telephone Company suffered even worse, as its poles were older and more heavily laden, but a large force of men were out repairing the work as fast as possible.

On Mohawk Street one pole line carrying four 10-pin cross-arms and one 150-pair telephone cable was broken down for a distance of 1200 ft., and the cable in falling on the wires of the trolley company was so badly burned as to be unfit for use. The poles were broken in various places, some close to the ground and some near the tops of the poles. In one instance a telephone pole about 50 ft. long was found to be broken in three parts.

The trolley lines of the Utica & Mohawk Valley Railway Company at this point were also put out of service, due probably to the falling of the Bell telephone lines rather than to the effect of the sleet on the trolley wires. The wires of the high-tension line of the Utica & Mohawk Valley Railway Company in Ilion and Mohawk did not seem to be injured by the sleet, although the insulators were still coated with ice at noon on Feb. 19.

Two pieces of ice, one taken from a 350,000-circ. mil cable and one from a No. 10 telephone wire, were weighed. Both

FIG. 2.—TELEPHONE WIRES ON 125-FT. SPAN AFTER SLEET STORM.

wires seemed to be coated with a thickness of ice about the same and the coating was on the under side. The piece of ice from the No. 10 telephone wire weighed ¾ lb. and was 10 in. long, making a uniform weight of 0.9 lb. per lineal foot. The piece from the cable weighed 1½ lb. and was 14 in. long, making a weight of 1.28 lb. to the foot. These were not exceptional specimens, but were a fair average of the general conditions. Some of the limbs broken from sound elm trees were as large as 12 in. in diameter. There were many places where pieces of the ice were completely broken away from the feed wires on one span and still remained intact on the adjacent spans.

Determination of the Distance and Direction of a Sending Station by Barretter Measurement.

By Bela Gati.

In the collision of the *Florida* and the *Republic* the value of the wireless telegraph for marine service received signal proof. Nevertheless, although the *Baltic, Lucania, La Lorraine, Furnessia* and *Seneca* were equipped with wireless telegraph, without the praiseworthy devotion to duty of Operator Binns, aid for the passengers of the *Republic* would doubtless have arrived too late, and in another similar case a like devotion might not have such a happy consequence. It, therefore, would be most desirable if, by means of automatic signals, a sinking ship could give notice of its distance and direction to other vessels. In case of the telegraph operator having sustained injury a sailor could then signal, say, the letter *t* at regular intervals, and this would quite suffice to determine the distance and direction of the imperiled ship. The writer here refers only to the case of a rescuing ship with an ordinary antenna, and excludes the case of a ship equipped with so-called directive antennæ.

According to Duddell's rule, the distance between a transmitter and receiver, multiplied by the strength of the incoming current, is a constant. This rule was proved by Duddell for considerable distances, but also applies to shorter distances.[1] If, for instance, this constant were 10,000 km-microamperes, then at 50 km the current would be 200 microamperes; at 47 km, 212.7 microamperes, and at 43 km, 188.6 microamperes. These values can be measured conveniently with the pointer galvanometer of a Gati barretter-measuring set.

For example, the rescuing ship—say, the *Baltic*—finds the incoming current to be 200 microamperes, and if after the run of 3 km on its original course the current is again found to be 200 microamperes, the *Baltic* knows that she is not nearing the *Republic*. Now, if the vessel changes to a course perpendicular to the former one, and after 3 km gets 212.7 microamperes, it will be known that she is on the right course, and that the distance is 47 km. One can always determine the distance of the imperiled ship by two measurements made on different courses with the aid of some calculations. It is not even necessary to know the constant. If the sinking ship does not emit waves constantly, the measures must be repeatedly made.

It is extremely desirable for wireless stations to apply the Duddell rule, particularly since the constant gives an indication of the efficiency of the station transmissions. Although damping measurements, as stated by Hahnsmann,[2] have only received recognition since 1906, and the proposed constant measurement has not as yet been put into practical use, it nevertheless seems to the writer that measurements of the kind suggested should be compulsorily exacted in the interest of humanity.

Tests of Watt-hour Meters.

The New York City Public Service Commission has printed a report prepared by Dr. Cary T. Hutchinson on tests of direct- and alternating-current watt-hour meters of the type used on central-station circuits in New York City. Sections of the report give the theory of the several classes of meters and the methods and conditions of test, as well as a brief description of each of the numerous types tested.

DIRECT-CURRENT WATT-HOUR METERS.

The report states that all direct-current meters submitted were Thomson watt-hour meters made by the General Electric Company, 17 types of which were tested. The conclusion from the tests is that any meter properly constructed in accordance with the design of any of these types will, when in good condition, register accurately within the limits specified below. It is added that this recommendation is based on what may be reasonably demanded of a modern direct-current energy meter, as summarized in the following outline specification. The range of load and voltage called for is considerably in excess of the variations which ordinarily arise under service conditions, these wide limits being chosen to get a measurable difference in registration, and at the same time to indicate the maximum error that might arise under extreme conditions of operation; the limits of error in registration specified refer to the tests made under laboratory conditions, where the meter can be carefully mounted and adjusted and every precaution taken to secure high accuracy in the measurement of the various quantities involved.

In regard to the adjustment of the meter at full load and

[1] Bela Gati, *Physikalische Zeitschrift*, 8, p. 686.
[2] Walter Hahnsmann, *Jahrbuch* der drahtlosen Telegraphie, 1909, p. 294.

light load, particular attention is called to the fact that in a number of the meters there is a marked shifting from day to day of these two supposedly fixed points on the registration curve (in some cases as much as 2 per cent), the meter being left untouched in the laboratory, subject to no outside influence except slight variations in the room temperature. To determine just what causes these variations would require a prolonged investigation; they are, however, probably due to temperature effects. In making comparative tests under various conditions, therefore, frequent determinations of the accuracy of registration at these two points should be made and the proper correction allowed for any change that may occur, particularly if the tests extend over a considerable period. Following are the specifications submitted:

Mechanical Construction.

Material and workmanship to be first-class in every particular, all fixed parts to be securely held in their proper position, moving element to be as light as possible consistent with proper strength and all bearing surfaces to be designed to reduce friction to the minimum.

Accuracy of Adjustment.

Meter to be capable of adjustment to register with an error of less than 1 per cent the true value of energy supplied through the meter at rated voltage and at either rated current or 10 per cent of rated current.

Accuracy of Registration Under Various Conditions of Load and Voltage.

After the meter has been adjusted as above specified, it shall register with an error of less than 2 per cent the true value of the energy supplied through it at rated voltage at any current from 10 per cent of rated current to 150 per cent of rated current; the error in registration at 5 per cent of rated current and at rated voltage shall not be greater than 7.5 per cent; the change in the accuracy of registration for a 10 per cent change in voltage either above or below normal shall not exceed 3 per cent at rated current or 5 per cent at 10 per cent of rated current.

Accuracy of Three-Wire Meters.

The change in the accuracy of registration of a three-wire meter when either one of the current coils is cut out of circuit shall not exceed 3 per cent for rated current through the remaining coil.

Effect of Change in Temperature.

The change in registration of the meter when the temperature of the room in which it is installed rises from 50 deg. Fahr. to 100 deg. Fahr. shall not be more than 5 per cent at rated voltage at either rated current or 10 per cent of rated current.

Effect of Temporary Overloads.

A temporary overload (three seconds) of 300 per cent of rated current applied five consecutive times shall not cause a permanent change of registration at rated voltage and rated current of more than 2.5 per cent for meters having a rated current capacity of less than 600 amp, or of more than 5 per cent for meters of larger capacity; the permanent change in registration at 10 per cent of rated current and rated voltage, due to such overloading, shall in no case exceed 5 per cent.

Loss in Current Coils.

For meters rated at 50 amp or less the total loss in the current coils at rated load shall not be more than 1 per cent of the total power supplied; for larger meters this loss shall not exceed *two-tenths of 1 per cent.* (0.2 per cent).

It is stated that this specification covers only those characteristics of the meter which may affect the accuracy of registration from the consumer's point of view—that is, a meter which fulfills the above specifications will, when properly installed and correctly adjusted, show no tendency to over-register, within the limits specified, under normal conditions of operation. There are, however, a number of other points which affect the excellence of an energy meter; namely, the friction of the moving element, the power lost in friction, in the potential circuit, and in the disk, the speed of the meter, the driving torque, the weight of the moving element, the ratio of driving torque to weight, and the ratio of driving torque to frictional torque. These data have been determined for all meters submitted, and in general it may be stated that it is desirable that a meter have the least possible friction, small loss in potential coil, high ratio of driving torque to weight, and high ratio of driving torque to frictional torque.

The following points regarding the design and use of the Thomson wattmeter are added:

The internal connections of a Thomson meter are such that the losses in the meter are borne in part by the supply company and in part by the consumer; the former stands the losses in the potential circuit, disk, and frictional resistance, the latter pays for the loss in the current coils. Consequently, from the consumer's point of view, the loss in the current coils only is of importance.

A heavy overload, such as a short circuit in the installation supplied through the meter, may cause a considerable weakening of the permanent magnets, and thus cause the meter to run fast. No attempt, however, was made to determine the effect of overloads greater than 300 per cent of full load, as it is always possible to protect a meter from heavier overloads by installing proper fuses or circuit breakers. If the meter is not so protected the consumer should be warned that a heavy short circuit may make his meter run considerably fast, and a readjustment of its speed after such a heavy overload should be requested. It should be noted, however, that the later designs of the Thomson meter are much less affected by overloads than the earlier types, as the magnets are so designed and are so arranged with reference to the current coils as to reduce this effect to a minimum.

The magnetic field produced by other instruments or wiring in the vicinity of a watt-hour meter may affect the registration to a considerable extent; particularly when the meter is installed on a switchboard on which are located busbars carrying heavy currents; the result may be either an over-registration or an under-registration, depending on the direction of the stray fields. By adjusting the meter after it is installed the effect of any constant stray field can be compensated for, but accurate registration is impossible when these effects are large and variable.

A watt-hour meter should always be installed in such a manner as to reduce mechanical vibrations to a minimum, as the friction of the meter is largely affected by such variations, which may cause the meter to run continuously or to "creep" when no energy is being supplied through it.

ALTERNATING-CURRENT WATT-HOUR METER.

Twenty-four types of alternating-current meters, representing 11 manufacturers, were tested. Of these 13 complied with the specifications given below. Concerning those which failed to meet these specifications, it is stated that with one exception all are of early design and no longer manufactured. In regard to commutator watt-hour meters, tests of this type indicate that they are only suitable for measuring energy supplied at a power factor of practically 100 per cent. Following are the specifications for alternating-current watt-hour meters:

General.

In the case of a three-wire single-phase meter, the limits of error specified, unless otherwise stated, refer to tests made with the two current coils connected in series and rated voltage applied to the potential circuit. In the case of a polyphase meter the limits of error specified, unless otherwise stated, refer to tests made with single-phase current, with both current coils of the meter in series and the two potential circuits in parallel and connected to a single-phase source of pressure.

Mechanical Construction.

Material and workmanship to be first class in every particular, all fixed parts to be securely held in their proper position, moving element to be as light as possible consistent with proper strength and all bearing surfaces to be designed to reduce friction to the minimum.

Accuracy of Adjustment.

Single-phase meters to be capable of adjustment to register with an error of less than 1 per cent the true value of energy supplied through the meter at rated voltage and frequency and

100 per cent power factor, at either rated current or 10 per cent of rated current. Each element of a three-phase meter to be capable of independent adjustment so that the meter will register on a single-phase circuit with an error of less than 1 per cent the true value of the energy supplied at normal frequency and 100 per cent power factor through either element alone, for either rated current or 10 per cent of rated current through that element, with normal single-phase voltage applied to both elements.

Accuracy of Registration Under Various Conditions of Load and Voltage.

After the meter has been adjusted as above specified it shall register with an error of less than 2 per cent the true value of the energy supplied through it at rated voltage, frequency and 100 per cent power factor at any current from 10 per cent of rated current to 100 per cent of rated current; the error in registration under the same conditions at 5 per cent rated current and 150 per cent rated current shall not be greater than 2.5 per cent; the change in the accuracy of registration at rated frequency and 100 per cent power factor for a 10 per cent change in voltage either above or below normal, shall not exceed 1 per cent at either rated current or at 10 per cent of rated current.

Effect of Change in Frequency and Power Factor.

A change in the power factor of the load supplied through the meter at normal voltage and frequency from 100 per cent to 50 per cent lagging shall not cause an increase in the speed of the meter at rated watts of more than 2 per cent, or a decrease of more than 4 per cent, and shall not cause an increase or decrease of speed at 10 per cent of rated watts of more than 4 per cent. A change of 10 per cent in the frequency of the current supplied through the meter at normal voltage and 100 per cent power factor shall not cause a change in the accuracy of registration at either rated current or 10 per cent of rated current of more than 2 per cent. A change of 10 per cent in the frequency of the current together with a change in the power factor from 100 per cent to 75 per cent lagging, the voltage being held at its rated value, shall not change the speed of the meter at either rated watts or 10 per cent of rated watts more than 4 per cent.

Accuracy of Three-Wire Single-Phase Meters.

The change in the accuracy of a three-wire single-phase meter at rated voltage, frequency and 100 per cent power factor, when either one of the current coils is cut out of circuit shall not exceed 2 per cent for rated current through the remaining coil.

Accuracy of Polyphase Meters.

A polyphase meter when adjusted on single-phase current as described above shall also register on a polyphase circuit at rated voltage and frequency within 1 per cent of the same accuracy shown on the single-phase test, both at 10 per cent rated current and at rated current at both 100 per cent power factor and 50 per cent power factor.

Effect of Change in Temperature.

The change in registration of the meter when the temperature of the room in which it is installed rises from 50 deg. Fahr. to 100 deg. Fahr. shall not be more than 4 per cent at rated voltage at either rated current or 10 per cent of rated current.

Effect of Temporary Overloads.

A temporary overload (three seconds), of 300 per cent of rated current applied five consecutive times shall not cause a permanent change of registration at rated voltage at either rated current or 10 per cent of rated current of more than 1 per cent.

Loss in Current Coils.

The total loss in the current coils of the meter at rated current shall not exceed *five-tenths of 1 per cent* (0.5 per cent) of the rated watts of the meter.

As in the case of the direct-current meters, this specification covers only those characteristics of the meter which may affect the accuracy of registration unfavorably to the consumer. The following points regarding the design and use of alternating-current watt-hour meter should also be noted:

The internal connections of these meters are such that the losses in the current coils of the meter are borne by the consumer; the other losses are borne by the company.

A heavy overload, such as a short-circuit in the installation supplied through the meter, may weaken the magnets and thus cause the meter to run fast, but the effect of such overloads on alternating-current meters is as a rule not as great as with direct-current meters.

Unidirectional stray magnetic fields of constant magnitude have no effect on the registration of an alternating-current meter; fluctuating stray fields or fields due to alternating-current circuits in the vicinity of the meter may, however, affect its registration. By adjusting the meter after it is installed the effect of any such field of constant magnitude can be eliminated, but accurate registration is impossible when such stray fields are large and variable.

Care should be taken to install the meter in a manner to reduce mechanical vibrations to a minimum; the final adjustment of the speed at 10 per cent and 100 per cent rated current should be made after the meter is installed and connected, taking the voltage and current for this purpose from the supply mains.

On account of the high reactance of the potential circuit of an induction meter, together with the fact that the coils in this circuit are wound on iron cores, the effective value of the current flowing in this circuit for a given impressed voltage will depend upon the shape of the pressure wave; consequently the torque, and therefore the speed, for a given load supplied through the meter will be a function of this wave shape. In case the pressure on a given circuit is supplied from different generators at various times, the effect of the maximum variation in wave form on the accuracy of the meter should be determined, and no meter should be allowed on this circuit which is appreciably affected by such variations. If the pressure on the circuit has a constant wave form, even though it may not be a true sine wave, then, by adjusting the meter after it is installed, using for this purpose the pressure on the supply circuit, the particular form of this wave will be immaterial, provided the accuracy of the standard with which the service meter is compared is not affected by wave-form variations. In the case of a polyphase meter, each element should be adjusted to read correctly when connected to the particular phase on which it is to operate.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

The Electric Vehicle Situation in Buffalo, N. Y.

By Geo. J. Kirchgasser.

The first year of the 20th century saw the first vehicles made in Buffalo using electricity for motive power, and since then, due to the steady advance made in mechanical construction, batteries and motors, the number of electric carriages, delivery wagons and trucks has increased yearly. To watch the Adams Express Company's electric wagons hurrying about the city, especially in the downtown districts, one cannot but realize their efficiency for this kind of work. They are driven up at a good speed, the parcel delivered, and are swiftly away again. Turning, stopping and starting can all be done much quicker than with a horse or with a gasoline automobile. Even for heavy trucks the advantage of electric power is being recognized, as the increasing number of this type in use shows.

There are approximately 400 electric automobiles used in Buffalo, about 350 of these being pleasure carriages, and the

remainder delivery wagons and trucks. The Adams Express Company has 20 1-ton trucks. The National Battery Company has one 5-ton, one 1½-ton and one 1000-lb. truck, besides five electric sight-seeing cars, which are run in the summer season. The Arctic Ice Company, Heinz Company, of Pittsburgh, and a number of other concerns use electric automobiles for business purposes.

Buffalo claims 340 miles of asphalt-paved streets, with no grades or hills to speak of, so that conditions are favorable to the use of electric vehicles. There are three public garages in the city; one connected with the National Battery Company; the Babcock garage, and a new one recently opened. The National Battery Company's garage is located on Massachusetts Avenue not far from the west side residential section. Besides a large garage used exclusively for electric automobiles, the concern manufactures a general line of storage batteries and others of a special type used in connection with a system of car lighting. The electricity for the whole plant is received from the Cataract Power & Conduit Company at 2200 volts. Rotary converters are used for charging. This garage is in the hands of a competent expert, Mr. W. P. Babcock. Between 65 and 75 carriages are usually kept here and 30 can be charged at one time. The rate for charging, storing, washing and delivery is $30 per month. An extra fee is charged for washing out the batteries. Close watch is kept of the batteries and a card system used, so that if a car has not been used the batteries are not charged, as Mr. Babcock claims that the active material is loosened and dropped to the bottom of the cell if the batteries are charged too frequently when only a small amount of the charge has been taken out. Of course, if the carriage is standing idle for some time, charging at intervals livens up the batteries. As the whole plant uses electricity, the cost per month for energy used by the garage can only be approximated at from $60 to $70.

The Babcock garage is connected with the Babcock Electric Carriage Company, and is located near the corner of West Utica Street and Elmwood Avenue in the residential section of the city. This garage does not use central-station energy. The electricity here is generated at 110 volts, gas engines being the prime movers. The cost of charging cannot be ascertained, as electricity is used throughout the factory. The number of vehicles boarded here is about 85, 40 being charged at one time.

The charge made for storage, washing, charging and delivery is $30, and the other conditions are about the same as at the National garage. The Babcock company at one time attempted making contracts, guaranteeing to maintain the batteries in good shape, to make all ordinary repairs, besides the storing and charging of the vehicle, etc., for one year at a certain figure, but abandoned the plan after a short time.

The third garage, located at Pennsylvania and Fargo avenues, has just been opened and at present boards less than 20 vehicles. This garage also controls the Buffalo agency for the Waverly cars.

All the trucks are charged at private garages with isolated plants, as are also a great many carriages. The Buffalo General Electric Company supplies energy to 36 private garages having mercury-arc rectifiers, 19 of which have been installed within the last year. The 30-amp rectifier is used in all cases except one, and all are connected to the alternating-current mains at 220 volts. The Buffalo General Electric Company has received no complaints in regard to the rectifiers. There is, though, a tendency for owners to charge too frequently, as some people plug in their batteries after every trip no matter how short the trip. The rate of 6 cents per kw-hour is made to these consumers on a guarantee of $50 per year. No restriction is made as to time of charging, the consumer being at liberty to use the energy at any time.

The Rapid Building of Power Load.

Mr. R. B. Boyce, manager of the Southeast Missouri Ice, Light & Power Company, of Charleston, Mo., has done some rapid work in building up power load in that town. Charleston is a small town in which day service was started in August, 1908. By April, 1909, 60 hp in motors had been connected. The motors range in size from 1 hp to 25 hp.

An Experiment with Flat-Rate Residence Lighting at Marshall, Mo.

The Marshall Light, Heat & Power Company, of Marshall, Mo., of which Mr. R. J. Irvine is manager, is trying an experiment with flat-rate lighting for small cottages that will be watched with much interest. The rate is $1 per month for four 25-watt tungsten lamps, 20 cents additional for each lamp up to seven, and 15 cents additional for each lamp more than seven. This flat rate is made on the condition that the customer uses only tungsten lamps. These lamps are sold to the customer at list price. It is explained to the customer that wasteful or unnecessary use of electricity also means unnecessary cost of lamp renewals to him. It is the idea that with tungsten lamps at the present high price there will be sufficient inducement to the consumer to turn lamps off when they are not needed so that waste of electricity will be prevented.

The company has had this arrangement in force about three months, and has secured 92 such customers in a town of about 6000 population. The flat rate undoubtedly appeals to many owners of small houses as a meter rate does not, because it is known that the bills cannot be in excess of the stipulated amount. The company reserves the right to install meters at any time if the contract is being abused by the installation of larger candle-power lamps than those contracted for, or by the use of carbon-filament lamps. The plan is considered by the company as partially an experiment and partially an entering wedge for regular meter customers. It certainly appears from the number of such customers connected in a short time that the plan is popular and works well as a means of getting service introduced among a large number of consumers. At the same time there is no expense for meters.

Conference on New Accounting System in Wisconsin

At an important joint meeting of the Wisconsin Electric & Interurban Railway Association, the Fox River Valley Gas & Electric Association and the Northwestern Electrical Association, held at Sheboygan, Wis., on April 12 and 13, the new accounting system prescribed by the Railroad Commission of Wisconsin was discussed. About 50 representatives of operating companies were present, and Mr. Ernest Gonzenbach, of Sheboygan, president of the Northwestern Electrical Association, presided. During the convention the visitors inspected the plant of the Sheboygan Light, Power & Railway Company, the gas-engine-driven generating station at Port Washington of the Milwaukee Northern Railway and the plant of a coal-loading and sorting company.

"The Practical Application of the New Accounting System" was the title of a paper presented by Mr. George Allison, of the Wisconsin Electric Railway Company and the Eastern Wisconsin Railway & Light Company. Mr. Allison distributed copies of the schedule of accounts which he had arranged under the new classification for the use of the companies with which he is connected. Mr. C. N. Duffy, of Milwaukee, said at the conclusion of this paper that he was pleased to learn that Mr. Allison had found the accounting system prescribed by the commission so well adapted for the use of his companies. Mr. Duffy thought that the public-service companies of Wisconsin were fortunate in having such a good commission, and further that the system of accounts presented was easily adaptable for large or small utilities.

Mr. A. D. Alt, manager of the Mondovi Electric Light Company, said that he had not yet adopted the new accounting system because there were several questions still pending with the commission. His plant is an offshoot of a flour mill which

obtained its power from a hydraulic plant and also from an auxiliary steam plant. Both methods of generating power were used as conditions demanded, and the milling and lighting employees are engaged in both kinds of work with no very definite demarkation. In this case it was difficult to see how to apportion the power costs so that the accounting system prescribed by the commission might be followed for the lighting plant.

Mr. Alt said, in relation to the methods of testing electric meters prescribed by the commission, that inasmuch as his company had but a small number of meters the expense for testing as prescribed was a hardship. Heretofore the meters had been tested at the factory, but the commission did not approve of this method on account of the possibility of damage during shipment, and Mr. Alt asked for suggestions as to how a small company could economically meet the commission's order, which said that meters must be tested on the premises—not at the factory or at the company's workshop. The commission also had said that there was no master meter for direct current that was sufficiently reliable.

Mr. Duffy said that in his view it was the purpose of the commission to obtain as clearly as possible cost figures for the generation of power by gas, steam and water, and he thought that such figures should be given by the companies willingly because of their value for comparison by the commission. He suggested that Mr. Alt ascertain the total cost of generating power for both the mill and the lighting plant and then apportion, according to the best possible estimate, the electric current consumed and lost in distribution.

Mr. Irving P. Lord, of Waupaca, said that the situation in his city resembled that described by Mr. Alt. In Waupaca the company obtains its power from a hydraulic plant and also from a steam auxiliary. In addition, there are both railway and lighting departments, but as the power requirements are fairly evenly divided, the charges for fuel, labor and general maintenance are apportioned one-half to the railway department and one-half to the lighting department.

There was considerable discussion of the subject of the proper way of accounting in the case of small motors, too small to have a separate meter, connected to lighting circuits. It might cost from $10 to $15 to install a meter for a small fan, for example, whereas it would be much more economical and practical to connect this motor to the lighting circuit. Mr. Lord remarked that he has 20 small motors connected to his system, the largest 7½ hp, and with the exception of a few all are provided with separate meters. Mr. A. Westermeyer, of Sheboygan, remarked that under the present system of accounting in that city the income from small motors on lighting circuits goes into lighting sales.

Mr. J. O. Posson, manager of the municipal plant at Algoma, said that the local authorities which had charge of the operation of the plant were studying the system of accounts laid down by the Railroad Commission, but in the past had not called for a separation for power accounts between the lighting and city water departments. Heretofore one man had done all the testing of meters by using a master meter kept at the plant. The city could hardly afford to send out men to test the customers' meters in place, and had asked the Wisconsin Railroad Commission to send a representative to Algoma to study the local conditions so that a ruling might be made.

Mr. V. E. Extrom, superintendent Electric, Water & Telephone Company, Tomahawk, Wis., said that the plant at Tomahawk was operated by water power, with a steam reserve, and the steam reserve was used either for running a sawmill or lighting the town. The company divided its charges for the operation of the steam plant on the basis of the current required for lighting purposes. Mr. Allison, in answer to a question, said that it was the office practice of his companies to pass all accounts through one voucher journal and then recapitulate at the end of the month by using a distribution sheet and taking the distribution direct from the voucher.

Mr. B. G. Broad, of the Milwaukee Northern Railway, presented a paper entitled "Methods of Changing from the Old to the New." This paper was largely devoted to railway work.

A paper of Mr. Halford Erickson, of the commission, on "The New Accounting System," was then read by the author. Mr. William J. Hagenah, of the accounting division of the commission, was then introduced, and he said that the classification of accounts which has been prescribed is the result of careful study of the systems in use in Wisconsin and also in other States. It is admitted that a great many of the items appearing in the forms of the commission have never been a part of the records of public utilities in Wisconsin. The effort has been to prepare a classification which shall suit the different utilities without establishing a precedent.

The classification is divided into two major groups, Class A and Class B, permitting comparison between accounts used in the smaller companies and the more detailed accounts of the larger companies. A feature of the classification is the accounting for all power used, whether generated, rented or purchased. Power is produced by two or three methods, and in some cases all of these methods are used by one company. The power account in the classification is divided into the different methods of power generation, as hydraulic, gas or steam generation. Then there is the possible cost of power that is purchased, and if each company will keep an accurate record of these various items, the question of power accounting may be settled. It would be manifestly unfair to compare the cost of steam power with that generated by hydraulic means. The same is true of gas-driven plants. These costs should be made public for the benefit of the patrons of each particular company. They can be determined in no other way than by separation of accounts, and when this is done the commission can determine whether the basis of sale is just to the public. In the case of hydraulic utilities transmission, transformation and (if necessary) storage-battery accounts are also included. When the cost of gas-power production is compared with the cost of steam-power production at the steam-power plant, it is necessary that the cost in each case shall equal the worth at each point. Consequently, the cost of hydraulic power would be the cost of the steam power at the place where it is being delivered.

There was some question of dividing expense accounts in Class A classification into two classes, as municipal distribution or contract lighting and commercial consumption. But it was decided that it would be better to keep only one set of accounts on this subject, and from the entries an analysis could be made by which the commercial lighting feature could be distinguished.

Treating of the undistributed accounts in the list in the second, or Class B, classifications, Mr. Hagenah requested that those companies preferring to distribute or itemize certain accounts indicate in each case the account into which the items have been distributed in order that the analysis of the commission may be facilitated. Depreciation has been provided for in a general way, but the commission has been unable to prescribe an exact percentage. However, depreciation is constantly going on, and it is desired that the physical and financial standing of each utility be known. This can be provided for by making actual reduction from revenue or gross earnings and making a fictitious book entry in the nature of an open or unadjusted account. Taxes are to be treated as an operating expense.

Mr. Hagenah was asked a number of questions in relation to the case of the flour mill and electric light plant, previously mentioned. He said that proper account should be kept as to the cost of operating, and should show whether the actual or primary use of the service was for the benefit of the mill or the electric light plant. In either case the total cost of generation and the kw-hours produced should be kept. Then at the end of the month there should be a careful analysis of the cost of producing this current and a proper apportionment made between the electric light plant and the mill. In relation to the subject of testing electric meters for small plants, Mr. Erickson said that the commission has established certain standards and that the decisions in relation to these contain practically everything that has been determined in relation to this subject. These decisions may be had from the commission on application.

Discussing the question of classification of electric light earnings, Mr. Hagenah said that the largest average amount of cur-

rent used, either for lighting or power, will determine whether the consumer is to be classed as a commercial-lighting or commercial-power consumer. All depends upon the proportion of current used by the consumer for lighting purposes and for power purposes. Where some current is used by the people of the house for small electric heating devices, such as flatirons, curling-irons, heater, etc., the classification would be that of electric lighting, probably. If, however, besides the lighting considerable power is used, as in the case of sewing-machines in tailor shops or "sweatshops" in residences, then the consumer may be classified as a power consumer as well as a lighting consumer, and separate meters should be installed to register the amount of current used in each case. The moment a motor of any kind uses the major portion of the current delivered to a customer, that customer should be classified as a commercial-power consumer. One reason why this classification is made is because of the difference in rates offered for power and lighting. Mr. Gonzenbach said that it was going to be a difficult matter in many cases to decide whether a consumer should be classified under lighting or power. Mr. Hagenah admitted that there might be cases where it would be difficult to draw the line, and in some instances the decision would perhaps have to be left to the auditor in making out his reports.

Mr. Erickson said that the commission is not going to require any impossible things of the utility companies. It is not intended to enforce any rules which are going to cause hardship or create any unnecessary burden on the State or its utilities. Mr. Gonzenbach said that the public-utility men had had enough experience with the Railroad Commission of Wisconsin to know that they would be fairly treated.

Answering Mr. Duffy in relation to classification where one company operates both electric light and railway service, Mr. Hagenah said that the station reports usually show the detailed cost of the current generated and that the railway should be charged with its proportion and the electrical department in like manner. Detailed costs of each distribution will follow.

Mr. Erickson explained that it is the intention of the commission simply to have a system of accounting under which detailed and definite reports can be made to it. Companies may subdivide these accounts to suit their own convenience. If desirable, one of the commission's accounts may be divided into two or three others, but they must not be subdivided so that they cannot be combined properly when the company makes its report to the commission.

In relation to the making of rates, Mr. Gunn said that the rates of his company start at 12 cents a kw-hour for lighting and 8 cents a kw-hour for power. The discount is arranged in such a way that those who use power during the day get the benefit of a very material reduction. This brings the rate down as low as 3 cents per kw-hour for large consumers. On this subject Mr. Erickson said that it is the intention to make rates that are equitable both to the utilities and to the various classes of consumers, providing for the lowering of rates as the cost of production decreases, so that the business of the plant will not be seriously affected by such action. The basis of rate-making should be the operating expenses of the plant; otherwise rate-making will be largely an estimate.

Further explaining his position, Mr. Erickson said: "The fixed expense—and there is a clearly defined fixed expense in all service—should be a service rate. It should be a charge upon the consumer because it is a fixed expense in connection with the installation. Having fixed a service rate for the consumer, you should have a specified rate added to it which should be computed upon the amount consumed per month. There are some particular objections to this form of rate. There are users of electricity who, if you were to charge them all you really should, would not take your service. Consequently, you must make some arrangement so that your rate will appeal to them and induce them to accept the service. You must take something from your fixed expense and add it to the variable expense; therefore, when you add the two together you will get a rate unit which, while it takes away the lower rate for the long-hour users, and makes it a trifle higher for them, will lower the rate somewhat to the short-hour user." Mr. Erickson said later: "Of course, the maximum-demand system of making rates is not correct. You know from experience what is the maximum demand for each class of consumer, and estimates on that demand are not absolutely correct, but they are not so far out of the way as to create an injustice."

Mr. Erickson remarked that in many schedules of electric light companies department stores are given a very good rate. They are, however, really very costly customers, because they use all their lights for a short time only. Mr. Duffy remarked that a store having a 500-light installation might use it six hours and another store having 3000 lamps installed might use them only one hour. To this Mr. Erickson replied that it would be manifestly unjust to charge them both the same rate. Continuing, he said: "In treating installations of this kind you must adjust your rate schedules. We are up against questions like that every day, and it is perhaps a thing that is troubling us more than anything else in our work. It is a question which has to be worked out and is in a way 'up to' all of us. The department store having a 3000-lamp installation takes a greater proportion of the demand than the 500-lamp installation. Now if you will proportion that charge upon the basis of the demand, will you not make the store with a 3000-lamp installation pay its proportion?"

Mr. Duffy pointed out that if this principle was applied to a man's residence his increase in rate would be from 25 to 50 per cent. He asked if it would not be a justifiable discrimination if an arbitrary rate were made so that the price to this man should not be raised. Answering this, Mr. Erickson said that some arbitrary adjustment may have to be made, but it will have to be done with a great deal of discretion so as not to establish a precedent.

Central-Station Facts and Factors.

In dealing with central-station matters the editorial policy of the *Electrical World* for years past has been to present to central-station men as much essential and fundamental information regarding the financial and engineering conduct of the central-station business as has been made available by editorial visits to such companies and by various public reports made by them. In the belief that a systematic tabulation of certain instructive items concerning the results being attained by central-station companies would be of interest and value, a collection has been made of information covering a certain set of items, these items having been formulated after consultation with various central-station men. The first tabulation of such information is given herewith. It is the intention to continue these tables from time to time as information is collected from more companies. The editors will be glad to receive such information from any of its central-station readers. Company names will not be published in any case, as they are not essential to comparisons of this kind. The companies are designated by numbers only.

The general items covering kilowatt station rating and population of districts served are given only for the purpose of affording an idea as to the size of the company. The other items are grouped under two general heads: (a) utilization of investment and apapratus; and (b) development of territory served. The items under utilization and investment of apparatus are intended to show to what extent the apparatus installed is being utilized to produce revenue and also how well the money invested is being used. Those items pertaining to development of territory served indicate to the manager and financier whether the territory served is very much underdeveloped as regards central-station service, or whether a saturation point is being reached which would call for very cautious investment in extensions and enlargements.

Taking up the items one by one, the "total investment per kilowatt of station rating" represents the outstanding funded liabilities in the shape of bonds, stock and similar securities per kilowatt of station equipment. If this figure is low, it does

not necessarily mean true economy in construction or a good present physical condition of the property. An excessive figure, however, is not to be looked upon favorably, as it indicates that the plant has heavy interest obligations. In some cases this figure is low, as the plant has been allowed to deteriorate to a point where complete rebuilding will soon be necessary. Sometimes, especially in the case of the smaller plants, the figure is low because extensions and improvements have been paid for out of earnings and are not represented by bonds and stock. In general, a plant which has been continuously maintained at a high state of efficiency has more investment per kilowatt than some less efficient and depreciated plant, this higher investment being justified by the earning power brought about by the better condition.

The item of "gross yearly income per kilowatt of station equipment" is one of the most instructive on the list and indicates whether a company is building up its load in such a way as to get the most profit out of every kilowatt of equipment. It also indicates whether the system of rates is such as to secure proper returns. Plants having considerable non-peak load are, of course, among those which show the highest yearly earnings per kilowatt of equipment.

The item "gross yearly income per $100 invested" shows the percentage of investment appearing in yearly gross earnings and to some extent indicates what percentage of net income on the investment may be earned with proper economical operation. "Yearly operating expenses per $100 invested" also gives an insight into the net earnings. "Average income per consumer" indicates whether the consumers are using energy in large or small quantities, or both, and whether there are large contracts to bring up the general average. "Total connected load in kilowatts per kilowatt of station equipment" indicates by comparison the diversity of the load obtained by various companies—that is, one company may have a character of load which calls for a larger station equipment per kilowatt connected than would another. This diversity factor is important in determining rates.

"The kw-hours sold or accounted for per 100 kw-hours generated" will depend on the thoroughness of meter testing, the size of transformers, the line losses and character of the load, whether almost entirely peak load or distributed over 24 hours.

The items on transformer capacity indicate whether an unnecessarily large capacity in transformers has been installed, practice differing considerably in this respect. The item "Kilowatt station rating per employee, all departments," by comparison shows whether the company is employing a greater or less number of men than the average for a given output. The "yearly load factor," which is obtained by dividing the average load for the year by the maximum peak load of the year, shows how fully the plant equipment is being utilized. A low load factor usually goes hand in hand with a low gross yearly income per kilowatt. It indicates that more use might be made of existing apparatus by cultivating the load for periods when the lighting peak is not on.

The purpose of the items under "development of territory served" has already been indicated. All these items based on population are open to the criticism that in most cases the population is not exactly known. A question is also likely to come up as to the territory actually served. The company may have a franchise over an entire town and yet serve only two-thirds of it. Furthermore, the interval from one census to another always gives rise to wild guessing. Nevertheless, these items based on population, applied with judgment, are of value as indicating the extent to which the business has been worked in different towns.

The criticism may also be made that figures based on the kilowatts of station rating are unfair to the companies which have had the wisdom to install considerable reserve machinery, whereas other companies have no reserve whatever during the December peak load. This criticism is just, but probably no better basis for comparison than station equipment can be devised. The majority of large companies have a reserve, either in the shape of an extra unit or in the overload capacity of existing units during the December peak. Probably the majority of small companies do not have such reserve, the breaking down of one unit involving either some interruption to service

TABLE OF CENTRAL-STATION FACTS AND FACTORS.

	0	1	2	3	4	5	6	7
A.—General Information.								
Number of company		1	2	3	4	5	6	7
Kw rating of stations	100 to 120,000	1.800	119,250	2,000	565	300	240	850
Total population of district served	1,500 to 2,400,000	30,000	2,425,000	25,000	10,000	5,000	1,500	10,000
B.—Utilization of Investment and Apparatus.								
Total investment per kw of station equipment	$60 to $600	$333	$420*	$375*	$133	$500*	$62.50*	$82*
Gross yearly income per kw of station equipment	$40 to $139	$58	$79	$80.75	$69	$122*	$48	$65
Gross yearly income per $100 invested	$18 to $79	$17.40	$18.70	$22	$52	$24.40	$77	$79
Per cent of gross yearly income spent for operation (including everything but interest and depreciation)	39% up	47.1%	62%*	39%	53%	60%	39%	39%
Yearly operating expenses per $100 invested	$13 up	$8.28	$13.60	$8.60	$27	$14.70	$30	$32
Average income per consumer	$30 to $118	$59.80	$118	$73	$75	....	$31	$37
Total connected load in kw per kw of station equipment	up to 3.34	2.34	*1.7	....	1.94	....	2.2	2.6
Connected kw load in lamps per kw of station equipment	up to 2.50	1.11	....	....	.87	....	1.54	1.44
Connected kw load in motors per kw of station equipment	0 to 1.00	1.12	....	1.0	1.09	....	0.37	0.84
Connected kw load in heating apparatus per kw of station equipment	0 to 0.67	0.11	....	....	....	....	0.10	0.32
Kw-hours sold or accounted for per 100 kw-hours generated	30 to 85	81	....	....	....	....	....	74.6
Kw transformer equipment per kw of alternating-current station equipment	1 to 1.7	1.03	1.78	....	....	....	....	....
Kw transformer equipment per kw of connected load	1 to 0.2	0.43	0.53	....	....	....	....	....
Kw transformer equipment per kw connected in residence districts	0.5 to 0.2	....	0.2	....	....	....	....	....
Kw station rating per employee, all departments	30 to 60	94 5	47	....	....	....	....	....
Yearly load factor (average load divided by maximum)	15 to 44%	32%	*39.6%	43%	*17%	44.2%	....	30%
C.—Development of Territory Served.								
Gross yearly income per capita of population	up to $8.50	$4.06	$3.90	$6.46	$3.90	$7.35*	$8.50	$5.51
Investment per capita	$22 down	$23	$22	$30	$7.46	$30	$10	$6.95
Watts station rating per capita	up to 160	70	49	80	56	60	160	85
Number of consumers per 100 of population	up to 25	7.2	3.3	8.8	5.2	....	25	14.8
Number of residence consumers per 100 of population	.....	5.3	1.6	7.2	....	10	....	10.4

*See notes in body of article.

or very low voltage. The only other basis of comparison of this kind which can be taken would be the maximum yearly load in kilowatts, but, as is well known, this maximum varies within certain limits in a surprising way from year to year, and would probably be even more unsatisfactory than kilowatt station equipment as a basis for comparison, as it would be as unfair to the company with a large reserve equipment as would the basis of station rating.

Column No. 0 on the table does not refer to any company, but gives approximately maximum and minimum figures on the various items which have been obtained from various sources. These maximum and minimum figures do not necessarily refer to companies whose statistics are given in the table, but are selected from statistics gathered from various sources. They are intended to be only approximate, and cover electric investment only, so that in cases where a company operates a steam or hot-water heating system in connection with its station the figures would not apply.

Column No. 1 gives data from a station in first-class physical condition in a manufacturing town. It is equipped with steam turbines, and, as shown in the table, has a large connected motor load, the motor load being practically equal to the connected lighting load. The yearly income is low in proportion to the investment, but the operation is economical and the equipment is in a stable condition which will call for no expensive reconstruction in the immediate future, but rather extensions of the existing plant. The gross yearly income per capita of population is above the average, and this is due to motor load rather than to lighting load, as is shown by the small number of consumers per 100 of population, which indicates that the residence-lighting business has not been extensively worked.

Column No. 2 contains statistics from a very large station, carrying on a great diversity of central-station business and also carrying a street-railway load. Half of the output goes to street railways. Were it not for this fact, the investment per kilowatt of station equipment would probably be in excess of $420. If all the station output were distributed for miscellaneous motor and lighting purposes, the necessary investment in distributing lines and substations would increase the investment per kilowatt of station equipment. As a general proposition, the larger the city the higher the investment per kilowatt and the lower the gross yearly income per $100 invested. It is therefore only by the economies possible in the operation of a large station that the latter is able to pay as well as a smaller plant, the investment per unit or rating being usually much higher. The figure given for this station on "connected load per kilowatt of station equipment" does not include the street-railway load. Otherwise the figure on connected load would probably be almost double what it is. The alternating-current distribution system of this company has connected 3.34 kw for each kilowatt of alternating-current substation equipment. The percentage of gross income spent for operation in the case of this company includes depreciation, which is not included in this item given for the other companies in the table. This accounts for the high percentage of operating expenses in a large company, which would be expected to operate very economically. It is also notable that the kilowatt station equipment per employee in all departments is not materially less in the case of a company like this than in the case of smaller companies. The yearly load factor given includes both the railway and lighting loads. The yearly load factor on this company's regular central-station business is about 31.4 per cent.

In column No. 3 are given the returns of a steam-turbine plant, having also a small hot-water heating load. This plant is in first-class condition. The investment figures given include the cost of the hot-water heating system and the figures on earnings include those from the hot-water heating. The notable points about this station are the high yearly load factor and the low operating costs brought about largely as a result of this fact. This load factor is the result of securing a lot of motor business which does not operate during peak-load hours.

Column No. 4 relates to a plant in which the investment per kilowatt is notably low because part of the construction was paid for out of earnings rather than by security issues. This low investment makes the gross yearly income high per $100 invested. A notable point about this plant is that the connected motor load slightly exceeds the connected lamp load. The yearly load factor in the case of this plant was obtained by assuming that the maximum load of the year equals the output of the plant, as the actual peak load of the year was not at hand. If the plant has considerable reserve equipment, the yearly load factor is, of course, better. It is seldom, however, that a good yearly load factor is found in a plant of this size.

Data of a station also operating a hot-water heating system are given in column No. 5. The high investment is accounted for by this fact. The earnings include those from the sale of electricity and hot-water heating. The gross yearly income per kilowatt of station equipment from the sale of electricity is $100 and that from heating $22. The yearly load factor of this plant is also remarkably high because of the extensive motor load which this company has worked up. The number of residence consumers per 100 of population, representing 1 consumer for every 10, is also higher than usual. Figures on this company indicate that it has developed its field to a point much higher than the average, both in motor and residence business.

In column No. 6 are given the returns of a remarkably small plant which has attracted attention all over the country on account of the high gross earnings per capita of population, amounting to $8.50 per year. In this town about 80 per cent of the buildings are reported to be wired. The low investment represented by stock is accounted for by the fact that since the original stock issue all extensions have been paid for from the earnings, thus keeping down the stock liabilities of the company, although the plant probably cost at least double the amount represented by the stock. The low cost of operation is partially due to the use of natural gas in gas engines. Much of the construction in connection with this plant is not of a very permanent character, which also tends to keep the investment down. The "watts station capacity per capita" of population is high, and would be expected as the number of customers per 100 of population is 25.

The station to which the figures in column No. 7 apply is operated entirely by water-power located a short distance outside the city. In this case the investment per kilowatt of equipment is low because bonds have been retired with money obtained from net earnings.

INTERIOR WIRING AND ILLUMINATION

Street Illumination by Arches in Fort Wayne.

In order to attract retail business, property-owners and business men of Columbia Street, Fort Wayne, Ind., have formed an organization to erect a number of arches to support electric lights on that portion of Columbia Street between Clinton and Harrison Streets. The committee, of which William Dreier is a member, has been appointed to look into the matter of the number of arches and their exact location and cost. Possibly the plant will be extended to include the approaching streets from the south and from Bloomingdale and Lakeside for a short distance.

Arc Lamp Electrode.

A patent issued March 30 to Freidrich Kalkner, of Nuremburg, Germany, describes an arc lamp carbon arrangement which consists in the use of a negative carbon relatively much smaller than the positive carbon and having a metallic casing. It is said that in practice it has been found that a smaller negative

carbon increases both the yield of light and the steadiness of the arc. On the other hand, the greater resistance of the very small carbon, if used bare, would cause it to become red hot along its entire length, and it would, of course, be rapidly destroyed. To obviate this latter difficulty, the slender negative carbon rod, which has a cross-section of only one-sixth that of the positive carbon, is covered with a casing of very thin copper; this casing is liquified at a distance of about 1 in. from the arc, the melted copper falls away in drops, and the metallic fumes do not pass into the arc. This small electrode can be used either in a horizontal arrangement or at an obtuse angle to the large carbon.

More Tungsten Arches in Grand Rapids.

The system of lighting business streets by means of arches of tungsten lamps, supported by span wires from building to building, continues to be extended in Grand Rapids through the efforts of various merchants' associations and the Grand Rapids-Muskegon Power Company. A contract has just been closed for lighting Ionia Street to the Union Depot with 16 arches. At this rate it will not be long until the entire business district of Grand Rapids, as well as some suburban business streets, will be lighted in this way. The Merchants' Association of Worcester, Mass., is giving consideration to a similar scheme of lighting.

Schoolroom Illumination in Boston.

A lecture on the artificial illumination of schoolrooms was given at the Harvard Medical School, Boston, on April 18, by Dr. Myles Standish, professor of ophthalmology at Dartmouth and Harvard. From the point of view of the specialist the speaker touched upon the difficulties of adequately illuminating 40 to 60 desks from fixtures, unless the objectionable and costly expedient of providing each individual desk with a separate light is undertaken.

It was pointed out that more attention should be paid to the decoration of the room, the present fashion of giving schoolrooms a dark tone being disadvantageous. The best color for the walls is a pale yellow-green, nearly white. In modern schoolrooms the windows usually occupy one-fifth of the wall space. The best shades are hand-painted gray-green. The desks and other furnishings in the room should be of light-colored wood.

In Germany and elsewhere there is a system of indirect illumination whereby the light source is entirely screened from below and reflected from the ceiling and upper part of the walls. Such a method lacks one important factor of daylight, namely, shadows; and if attempted with incandescent lamps requires a maximum of expense to produce a comfortable sense of sufficient illumination. A widely extended experience has shown that while indirect illumination may be satisfactory for halls it is not suited for schoolrooms. The Boston school committee has rejected indirect illumination. After a series of experiments with incandescent lamps it was determined that a distribution of the lighting sources through the room was desirable, and that bare lamps without shades should not be used. It was found that most of the shades on the market confined the illumination to a relatively small area directly beneath the fixture, and that others transmitted the light and diffused it widely, but were undesirable because of the facets, which became multiple sources of brilliant illumination. When the committee finally experimented with the Zalinsky shade it was found that sufficient light passed through it to properly illuminate the ceiling and upper parts of the room, but that the greater proportion of the light was reflected downward at such an angle that the direct illumination was surprisingly great. The committee also determined that in most cities the cost of electricity, with a proper choice of lamps, is not so much greater than the cost of gas as to be prohibitive.

Preservative Treatment of Line Poles.

In the report on line poles purchased in 1907, compiled by the U. S. Bureau of Census, in co-operation with the U. S. Forest Service, and issued as publication No. 9 of "Forest Products," it is stated that the use of preservatives superficially applied has grown very rapidly during the last few years. Among the substances used are creosote, tar, tar oil, asphalt, crude petroleum, and various patented preparations. This manner of applying the preservative has the advantage of simplicity and cheapness, and for many conditions has proved valuable, adding considerably to the life of the pole. This process should not, however, be regarded as a substitute for the more efficient impregnation of the wood with the preservative.

Impregnation is usually effected by means of pressure pumps, the timber being placed in strong retorts hermetically closed. Recently, however, what is known as the "open-tank" or "non-pressure" process has been developed, whereby atmospheric pressure is employed to drive the preservative into the wood by a simple alternate heating and cooling of the pole in the treating liquid. The poles may be placed upright in the tank, so that only the butt is impregnated, since this is the part most liable to decay and hence most in need of treatment. The advantages of this method lie in the decreased cost of the apparatus required and the very considerable saving of preservatives.

Extensive experiments have fully demonstrated the practicability of the open-tank process for many conditions. In a test recently conducted in southern California, about 1800 poles were treated by various preservatives, and careful records will be kept of their comparative durability.

A 40-ft. Southern pine pole with a 7-in. top contains about 25 cu. ft. Assuming an absorption of 8 lb. of creosote per cubic foot of timber, or 23½ gal. per pole, with the cost of creosote at 10 cents a gallon, the preservative will cost $2.35 per pole. Allowing 50 cents for labor and seasoning charges, the total cost of treating the entire 40-ft. pole will be $2.85.

In California the standard 40-ft. Western yellow pine pole contains about 26 cu. ft., and creosote costs there about 20 cents per gallon. The actual cost, therefore, of treating the entire length of the pole will be about $5.40. If, however, only the butt of the pole is impregnated, only about 6 gal. of oil and preservative will be required, and the total cost will be reduced to about $1.52 per pole. The prices quoted do not include profit.

Building Up Load at Rockford, Ill.

The Rockford Electric Company has been doing some very active work in the building up of its load since the American Gas & Electric Company took hold of the property in 1907. Most of this development has been made under the management of Mr. F. H. Golding, formerly assistant manager of the Dayton Lighting Company, who assumed the management of the Rockford Electric Company in the fall of 1907. At that time the company was just beginning to give electric service in the outlying districts of the city. Formerly there was only a direct-current distribution system covering the downtown district and certain residence streets.

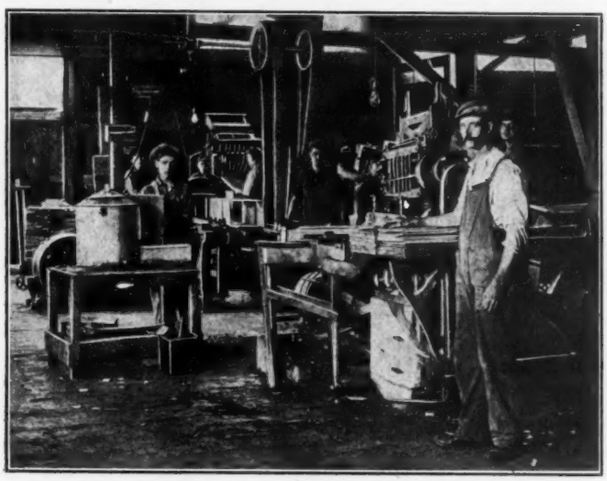
Rockford is a city which offers exceptional opportunities to a central-station company for building up a motor load among manufacturers. There are 350 factories of various kinds in Rockford, some of them very large. Rockford has sometimes been called the "Lowell of the West" on account of the large factories which were years ago attracted to its water-power. The water-power, however, is very limited and nearly all of the factories are operating with steam. These factories are said to employ in the neighborhood of 11,000 persons. The city has 26 furniture factories, 17 machine-tool plants, 4 immense knitting plants, 1 farm-implement factory, covering 25 acres, and a malleable-iron works covering 15 acres.

The Rockford Electric Company originally operated on water-

power, but soon outgrew this until its generating plants in Rockford now contain 600-kw in water-driven machinery and 4700-kw in steam-driven machinery. The last two steam units installed were 500-kw turbines. The company has for some time carried all of the electric railway load of the city and interurban lines centering in Rockford. The central-station generating system is, therefore, of a size where highly economical machinery can be used from now on, and the company is in a position to solicit the motor business of the large manufacturers, as well as that of the small.

At the time the American Gas & Electric Company took control in May, 1907, the company had 1369 consumers. In February, 1909, the number had increased to 2667. In May, 1907, the connected lighting load was 1500 kw, or the equivalent of 30,000 50-watt lamps. In February, 1909, the load had increased to 3000 kw.

The connected horse-power in motors shows a similar proportion of increase. In May, 1907, the connected motor load was 1720 hp. In February, 1909, it was 3300. During the time of this increase the direct-current distributing system was being reduced in area, but the connected load on the direct-current system was being increased, so that the direct-current load remained about the same as before the restriction of territory. As far as the generating plant is concerned, therefore, the alternating-current machinery has taken most of the increase. The



INTERIOR OF PLANT OF THE GREEN LUMBER COMPANY, SHOWING ELECTRICALLY HEATED GLUE-POT.

connected load of the company in December, 1908, was a total of 5200 kw, not including the street and interurban railway systems or the city arc lamps. The maximum load, exclusive of these systems, was 2595 kw. The load factor on the generating stations, including the railway and street-lighting loads, for the year 1908 was 38 per cent.

The W. F. & John Barnes Company's machine-tool plant is being rearranged by degrees so as to use electric motors exclusively. At present, 67-hp in motors is connected at this plant, and also a lighting load of 141 5-amp arc lamps and 286 16-cp incandescent lamps. In the knotting machinery factory of the Barber-Coleman Company, 200 hp in motors is connected. In the large wood-working plant of the Green Lumber Company 240 hp is connected. An interesting feature of this plant is the 25-gal. glue-pot seen at the left of the accompanying illustration. This glue-pot consists of the ordinary outer and inner receptacles used in glue-pots, the water in the outer receptacle being kept hot by means of a 2300-watt Simplex immersion coil.

Energy is sold on a readiness-to-serve or Doherty rate, consisting of a fixed charge of $1 per month per horse-power connected, plus 3 cents per kw-hour for energy used, with a sliding scale for large consumers. A readiness-to-serve rate is also used in connection with lighting, the consumer being given the option between this and a sliding scale, ranging from 13 1/3 cents to 8 cents per kw-hour, with 10 per cent discount, the sliding scale being based on a minimum guarantee per month for each rate. The lighting readiness-to-serve rate is $1.80 per year per 16-cp connected, plus $12 per year consumers charge, plus energy at 4 cents per kw-hour. The fixed charge per month of the readiness-to-serve rate is based on the candle-power and not on the wattage of the lamp.

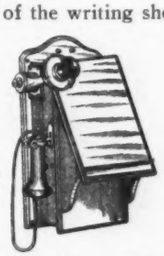
In soliciting for business there is one man who devotes his attention to motors, one to residence lighting and steam heat. There are two men working on commercial or business district lighting, one having the business district on the west side and the other the two business districts on the east side of the river.

The company runs two advertisements per week in each of the two weekly papers. The writing of advertisements is divided up among the soliciting force, each solicitor writing an equal number of advertisements per week.

New Telephone Patents.

WALL TELEPHONE SET.

A new idea in the design of telephone wall sets, as patented by Mr. R. Hansen, of Sioux City, Ia., is shown in the accompanying illustration. There seems to be considerable merit in this arrangement of parts, as it will be seen that the face of the user is to one side of the writing shelf and, therefore, he is



HANSEN SUBSTATION TELEPHONE SET.

better able to see what is being written. The filler piece between the shelf and the face of the set proper carries the ringer, the gongs being downward beneath this filler. The whole face and shelf of the set is hinged so that it may be swung out to expose the working parts.

TRANSMITTER.

While it has been customary to support the microphonic button of solid-back type transmitters by means of a rear stud extending through a solid bridge, the button may, if desired, be supported by a clamp about its body. Such a transmitter is that for which a patent has been granted to Mr. Hansen. He has provided the bridge with a central aperture of size just to take the cylindrical microphone button casing. Slits run longitudinally of the bridge from this central aperture, terminating in circular enlargements. This forms a spring, or flexible clamp, the button being held by tightening this clamp by means of set screws running transversely through the bridge. The advantage of this method of supporting the button by means of a clamp about its cylindrical body is that it permits of insulated electrode contact studs from both faces of the button. At the same time the enlargements at the ends of the slits provide for the insertion of insulating bushings for supporting the transmitter terminals, conductors extending from these terminals to contact studs.

CALL-REGISTERING SYSTEM.

With an idea of automatically recording calls attempted in the absence of a subscriber, Mr. R. D. Lamson, of New York City, has invented a telephone recording apparatus in the nature of the usual telegraphic or fire-alarm recorder and adapted to be connected to a telephone line in such a manner that anyone calling and receiving a "Don't answer" may forward the proper signals, recorded upon a tape, to indicate the time at which the call was made and also the number and exchange of the calling subscriber. The problem, of course, is largely one of adapting the control mechanism of the telegraph recorder so that it will be responsive to currents designed for it and yet not be responsive to other currents upon the telephone line required for the usual purposes.

Letters to the Editors.

Valuation of Public Utilities Properties.

To the Editors of Electrical World:

Sirs:—I have been interested in your discussions of the recent decision of the U. S. Supreme Court in the Knoxville, Tenn., water case, particularly your editorial of Feb. 11, 1909, Mr. Winslow's letters of Feb. 25 and March 25, and Mr. Haskell's letter of March 18.

The valuation of the plants and properties of public utility companies is growing in importance, not only in view of their occasional purchase by municipalities, but more particularly on account of the growing tendency toward their regulation, and the fixing of equitable rates, by duly constituted legal authorities. It is important, therefore, that sound ideas upon these questions should prevail.

I do not agree with Mr. Winslow as to the unfairness of recent court decisions and other precedents. In my judgment both the public and the utilities generally are to be congratulated upon the progress that is being made toward fair and intelligent views of these very complicated matters.

Mr. Winslow's principal contention is that rates based upon present value of plant—which means reproductive cost less depreciation—are unfair to the utilities, and must eventually bankrupt them. In his judgment rates are properly a function of reproductive value. He also contends that the worth of any given service to the user is independent of the value or age of the plant rendering it. Another contention is that most utilities have a hard time meeting expenses in their earlier years, and to maintain a depreciation account then is a serious handicap.

As to the first argument, I have pointed out elsewhere that the authorities were practically unanimous against this view. It has everywhere been held that the value to be considered in rate making is the present value. As to Mr. Winslow's second point, service from a new and up-to-date plant always commands better prices than from an old and worn-out one, just as a new house will bring more rent than an exactly similar, though older one. Passing this by, however, is it true that the consumer should pay the same rate irrespective of the value of the plant rendering the service?

In this connection it should be remembered that the tendency of the day is to base such rates, not upon the worth of the service to the consumer—for that is an extremely variable and intangible matter—but upon the cost of rendering that service. There is justice in this for the reason that the public is in a sense a partner in the enterprise to the extent at least of the franchises which have been given. The utilities are the agents of the public in rendering a service which is necessarily monopolistic in its character.

In ascertaining the cost of rendering the service the value of the plant is important in that it forms the basis for computing the annual fixed charges, namely, the interest and the increment to sinking fund to cover the depreciation of the plant. The value at any date is found by deducting from the cost of the plant—original or reproductive—the amount which has accrued in the depreciation account by annual payments and interest, up to that date. Let us consider a number of different methods of computing fixed charges:

1. Where the depreciation account is started at the beginning of the plant's service and is continued uniformly throughout its entire life.

2. Where that account is not started for some years after the plant begins service. This may be considered in two ways: *a*. When it is begun reasonably early; and *b*, say, midway of the life of the plant, a plan which Mr. Winslow seems to favor.

3. A readjustment on the basis of reduced value of plant; *a*, about midway of its life; and *b*, say, every five years.

Let us take a plant costing $600,000, and having an assumed life of 50 years. This is, of course, much longer than the life of an ordinary electric plant, and is even somewhat beyond that of the average waterworks, although perhaps not much too great in the case of the best modern systems. Assume interest on capital investment to be 6 per cent, and that the annual increment to sinking fund is compounded at 3½ per cent interest.

Under Plan 1 the annual credit to sinking fund would be a sum which, compounded as above, would amount to $600,000 in the assumed life of the plant. This would be accomplished by an annual depreciation charge of 0.763 per cent. Adding interest, the total fixed charge becomes 6.763 per cent on $600,000, or $40,578 per year.

If the starting of the sinking fund is deferred for, say, 10 years (Plan 2*a*), then the fixed charges during that period would be only the $36,000 interest, but the plant would have to earn in the remaining 40 years the entire $600,000, which would require an annual credit to sinking fund of 1.183 per cent. At the end of the 10-year period there would be a sudden addition to fixed charges of $7,098, making a total of $43,098 for the rest of the plant's life.

If, however, no depreciation fund has been maintained at all during the first half of the plant's life (Plan 2*b*), then the fixed charge during that period would—as before—be the interest only, $36,000. During the remaining 25 years, however, the entire $600,000 must be earned, which would require an annual charge of 2.567 per cent, or $15,402, making the total $51,402.

Plan 3*a* involves a readjustment of rates about midway of the life of the plant, which in the case of a waterworks may be assumed at about 25 years. This is reasonably close to the time when many such franchises expire. Assuming the plant to have maintained a sinking fund for depreciation in accordance with Plan 1, it would have accumulated at the end of 25 years approximately $200,000. Deducting this from the original cost of $600,000—which for our present purposes may also be taken to represent the cost of reproduction—leaves $400,000 as the present value of the plant. As the remaining $400,000 must, however, be earned in the remaining 25 years' life, there must be an annual charge for sinking fund of 2.567 per cent, a total of 8.567 per cent, or $34,268. It is this reduction of $6,310, under Plan 1, to which Mr. Winslow objects.

Under Plan 3*b* the readjustment is made every five years, as has been proposed in some municipal plants where the sinking fund is devoted to paying off bonds at regular intervals. To thus retire the entire $600,000 in 50 years would require $60,000 every five years, to provide which there would have to be assigned to the sinking fund each year 1.865 per cent, or $11,190, the same to be compounded annually at 3½ per cent. During the first five-year period, therefore, the fixed charges would be interest, $36,000; depreciation, $11,190; total, $47,190. As the bonded indebtedness would decrease by $60,000 every year, the interest charge would fall $3,600 to correspond. The amount thus earned for fixed charges would therefore vary from the above $47,190 during the first five years, down to $14,790 during the last period, as shown in the following table:

Period.	Value of plant as indicated by outstanding bonds.	Fixed Charges. Interest.	Depreciation.	Total.
1st 5 years	$600,000	$36,000	$11,190	$47,190
2d 5 years	540,000	32,400	11,190	43,590
3d 5 years	480,000	28,800	11,190	39,990
4th 5 years	420,000	25,200	11,190	36,390
5th 5 years	360,000	21,600	11,190	32,790
6th 5 years	300,000	18,000	11,190	29,190
7th 5 years	240,000	14,400	11,190	25,590
8th 5 years	180,000	10,800	11,190	21,990
9th 5 years	120,000	7,200	11,190	18,390
Last 5 years	60,000	3,600	11,190	14,790

If the bonds must be retired in a shorter period—say, 20 years, as is sometimes required—the fixed charges would be much larger during the earlier periods.

If the bonds must be paid off at regular intervals, and the depreciation account kept up as an additional and separate matter, as seems to be required by law in some municipal plants, then there must be in addition to the fixed charges of Plan 3*b* a further depreciation charge as per Plan 1. It is needless to say that such an arrangement involves such high rates for service as to be practically prohibitory.

These plans differ widely as to the amount of fixed charges which the plant should earn, and to secure which rates must

be adjusted. Plan 1 has much to commend it, but might be criticised from the company's standpoint as requiring a depreciation account from the beginning, which it might not be possible to maintain, but which it might readily earn later—even in increased amount—as the business develops. It may be also criticised from the standpoint of the public in that it maintains the full interest charge throughout the life of the plant, when the total might be reduced by using the depreciation fund to retire the bonded indebtedness, thus stopping 6 per cent interest instead of letting the fund grow at 3½ per cent.

Plan 2*a*, which seems to carry out the Wisconsin and Cincinnati ideas, and to that extent meets Mr. Winslow's criticism, has, however, the serious objection that it is adjusted but once, and then involves a sudden increase of nearly 20 per cent.

Plan 2*b* is open to the same objection, but to a much greater degree, the sudden increase being $15,402; in addition to which the interest on the full value of the plant must continue. Furthermore, rates fixed on this basis increase the value of the property 50 per cent.

Plan 3*a*, the one most generally followed, has the sanction of the best authorities. The entire $200,000 which has accumulated in the sinking fund is charged off, and a new one started, based on the then value of the plant, $400,000, and the depreciation is fixed at a sum which will return that amount at the end of the life of the plant. It will be noted that this arrangement effects an annual saving of more than $6,000 over Plan 1. It is, of course, true that on this basis the owners will not have in hand at the end of the plant's life the $600,000 necessary for its reproduction; but if the difference of $200,000 had accrued in the sinking fund at the beginning of the new period, it could have been paid back to the stockholders then, or used for retiring bonds. The additional $200,000 needed when the plant must be replaced is in the nature of betterments, and could very properly be met with new capital. This, of course, would then involve making a fresh start according to Plan 1, and a corresponding revision of rates.

Plan 3*b* appears to have no advantages other than a constantly lowering of fixed charges which would permit a corresponding reduction of rates. As this, however, calls for large earnings during the earlier years of the plant's life and reduced earnings later, it is exactly the opposite to the usual experience of such plants. Furthermore, such a plan would involve a great increase of fixed charges, and of rates to correspond, when it became necessary to rebuild the system.

On the whole, I am inclined to think that Plan 3*a* is as near an equitable solution of this vexed problem as can be reached. It already has the sanction of the best authorities, and permits that reasonable reduction of rates which seems to be demanded by the trend of the times and which is usually warranted by increased business, and better and more economical facilities.

St. Louis, Mo. William H. Bryan.

Patent Reform.

To the Editors of Electrical World:

Sirs:—The need of reform in the patent laws is constantly forcing itself on public attention, as is indicated by the discussion of the subject in your columns and elsewhere. That in the progress of events an intricate system of abuses has grown up admits of little doubt. The remedies, however, are not quite easy to apply, without so radical a change of procedure as to amount to a complete revolution in present practice. The fundamental intent of the patent law is found in its direct authorization in the Constitution itself. The clear intent of this authorization was to encourage the useful arts by granting temporary monopoly to inventors. This beneficent purpose is carried out by the existing statutes only insofar as they operate to secure such a monopoly. On the face of every patent issued are the following words: "Now, therefore, these letters patent are to grant unto the said (A. B.) his heirs or assigns for the term of 17 years from the (.....) day of (.....), (.....), the exclusive right to make, use and vend the said invention throughout the United States and the Territories thereof." On its very face the thing granted is not only the right but the exclusive right to "make, use and vend" the invention described in the letters-patent; and insofar as the patent laws fail in this they fail of the purpose for which they were authorized in the Constitution. Whatever the original conditions may have been, it is now only too obvious that the inventor actually receives very little more than a slight presumption of right in the subsequent litigation. Even the right to make the very thing described in the patent is not his unless he can establish it against all comers in a series of suits that may last the full term of this patent.

A very brilliant patent lawyer, winner of many a hard-fought suit, recently delivered an address on the protection afforded by the law to secret processes, and made it extremely clear that within the range of things that can properly be held as trade secrets, the rights of ownership will be rigorously upheld by the courts, in such cases the procedure to secure protection being on the whole less cumbersome than in suits under the patent laws. It is the custom to blame patent attorneys for many of the abuses that exist, but in fact these have grown up so gradually that they cannot be charged to any one class or influence. Besides all this, the Patent Office is being now used in ways that certainly could not have been foreseen by the founders of the system.

The fundamental presumption unquestionably was that the thing patented would be made, used and sold. That patents should be obtained for the purpose of preventing this object was a thing evidently not considered. There were no trusts a century since, exhausting their ingenuity in devices to prevent competition—no great companies maintaining patent departments bigger than the whole staff of the Patent Office in the earlier days. Any changes made now in the statutes or rules must contemplate not only protection for the legitimate rights of the inventor, but the securing to the public the benefits of his invention. If they fail in this they fail in the very object for which the patent system was authorized: "to promote the progress of science and useful arts." For their progress is not promoted by making it easy to tie up improvements for 17 years. The ways of the large interests in the Patent Office are familiar. For each patented thing made, used and sold there are a dozen or a score of patents secured which block the way to all lines of improvement. Some of them are doubtless taken out in good faith as improvements and laid on the shelf for one reason or another. Others are merely dogs in the manger, useless in themselves, but holding the way for ferocious attacks when the real improvement comes along. For the protection of the rights of the public the laws should be so modified as to compel the owner of a patent, in Down East parlance, to "fish, cut bait or go ashore" within a reasonable time.

Adequate remedies for complicated ills are never easy to prescribe. In the present case, however, some of the ills can be definitely located in the Patent Office practice, and can be reached without the use of drastic remedies. One of the most serious things in the system is the granting of too many broad patents—broad at least in the verbal scope of the claims so that their limitations can only be discovered after wearisome litigation. It is very common to find attached to a definite and comparatively simply specification, claims which when rigorously read upon it are fair enough but may in turn cover many things besides, and which may years later be made the basis of suits only to be decided by a long and costly fight in the courts. In theory such claims are supposed not to be allowed, but in practice they are exceedingly common. If the inventor were compelled to stand closely by his actual invention so that its scope should be clearly defined in the claims and not permitted to go beyond the perfectly definite statement of the specification, litigation would be greatly decreased. This reform can be put into effect by any clear-headed and forceful Commissioner of Patents who has an adequate force of assistants put at his disposal by Congress. It implies merely a more thorough search into the state of the art and a determination

to hold the language of the claims hard down to the thing actually invented. As things now are it is frequently possible to dodge an obvious reference by mere verbal juggling, perhaps securing in the end what is apparently a basic pattern carrying with it the presumption of broad validity.

Of radical changes in the patent laws many have been proposed, based commonly on provisions in some of the foreign patent systems. Provision for compulsory working, with forfeiture in unworked patents after a comparatively brief time, is a favorite scheme of reform. In certain cases the desired results might perhaps be attained, but upon the whole we see small chance of accomplishing much in this way. Many foreign countries have compulsory working laws which actually do not mean much, and in particular they would not remedy some of our most crying evils. They would not, for instance, deter large companies from going through the motions of working, while they would almost inevitably wreck the inventor of small means if the provisions of the law were anything but farcical. The strategic patterns owned by trusts are valued not for the inventions as such, but for their possible hold and restraint on the business.

A few thousand dollars spent in going through the form of working can be well afforded for this purpose, while the independent inventor would generally go to the wall, especially if his pattern covered intricate machinery. A suggestion made by Mr. Isaac L. Rice in the abstract of his *Forum* paper printed in your columns is based on a provisional grant for six months during which the patent is subject to attack. If it survives this period of litigation it is to be held valid. This device looks pretty fair—more promising than it really is. For in the first place the big interests would make a point of fighting everything that looked promising, thereby generally wearing down the inventor by the heavy costs. And second, if the patent stood fire successfully, infringers would have to be sued, as is now the case, the only gain to the patentee being that infringers would be estopped from invoking the defenses that allege invalidity. The exact scope of the patent would still remain to be determined. A more useful thing, of which Mr. Rice makes mention, would be a compulsory license law, able on the one hand to protect organized industry from disaster, and on the other to insure some return to the patentee in cases where he now gets nothing but a lawsuit. But in order to make such a law effective the patent must be so difficult to invalidate that would-be infringers would be discouraged.

Back of all legal reforms must lie such rigorous action in the Patent Office as would give the patent not only a presumption of validity but practical certainty, within the limits of its specification. The statute should be so modified that the office can say to the inventor: "This thing which you have patented is yours to make, use and vend and no action shall lie against you so long as you stick to your specifications. You are found, however, to have made, not a complete original invention, but a patentable improvement on the devices of A, B and C, which were cited against you, and you must demand licenses of them if you wish to manufacture." The preliminary publication suggested by Mr. Rice will then be reduced to a device for getting overlooked references before the office, the commissioner to have final jurisdiction with liberty to hear counsel and summon experts in his own behalf if he desires. If licensing is made easy it will not pay to risk infringements.

The general procedure suggested might be modified in various ways, but essentially it would cover the following points: First, the search would be made thorough enough to disclose clear ground of infringement as between patents in the prior art and the thing shown and described in the applicant's specification. Instead of being allowed to dodge citation by mere verbal changes in claims, the applicant would have either to amend his case so as to be absolutely clear of them in fact or take a patent merely for his improvement, issued as specifically subject to the cited patents. Second, after issuance of provisional protection a public opportunity to bring to the attention of the office any patents which should have been cited, merely for the information of the Patent Office, which would then reopen its inquiry and continue its action. The commissioner might receive briefs from interested parties and call experts for his own information, if necessary, but should have final authority to pass on the scope of patents cited—just as he does now within the limits of the present practice. Third, the final issue of the patent either cleared entirely by specific limitation or directly subject to broader patents—in either case carrying the right to make, use and vend the thing shown and described undisturbed, having when necessary secured license from the owners of controlling patents. Fourth, a compulsory license law to insure getting such license.

The result of this would be to give a patentee a clearly defined right to manufacture under his patent, and to stop infringement suits save against absolute pirates, who would have no standing in court. If anyone tried to dodge a patent by trivial modifications, he should have no standing unless he had faced the Patent Office with it and settled his rights. The expense of such procedure as here suggested would be somewhat higher than at present, but far less than the present fees plus almost inevitable litigation. The chief things to be determined by the courts would be the value of license rights, and the bulk of the tedious legislation now common would be avoided. Best of all, there would be little use in taking dog-in-the-manger patents under which licenses could be demanded.

New York. Inventor.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Centrifugal Coupling.—J. Fischer-Hinnen.—Polyphase induction motors with squirrel-cage secondaries have the disadvantage of a low starting torque and a high starting current. These disadvantages may be overcome by starting the motors without load and automatically coupling them when a certain speed is reached. The coupling of the author, in which use is made of the centrifugal force, is shown in Fig. 1. As shown in the diagram, two leather strips are fixed to the periphery of the inner half of the couple. By means of centrifugal force these leather strips are pressed against the inner periphery of the outer half of the coupling and by the resulting friction, the outer half is carried along. For higher speeds, the weight of the two leather strips is generally sufficient to produce the necessary friction. For low speeds a sheet of lead or iron is placed between the two leather strips in order to increase the friction. At normal speed the slip remains below 0.3 per cent. A special property of this coupling is that it is not necessary to avoid small eccentricities of the two machines coupled together.

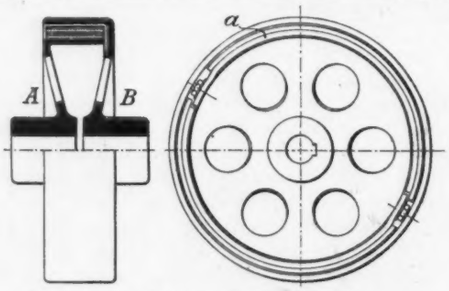


FIG. 1.—DIAGRAM OF COUPLING.

The coupling is also particularly suitable for single-phase motors.—*Elek. Zeit.*, March 25 and April 10.

Effect of Damping Coils.—I. Doery.—A theoretical note on the action of damping coils on pole-wheels of alternators operating in parallel. The damping coil has two functions. The first is to decrease the oscillations due to the forced oscillations of the prime mover and to the reaction of the generators. The second is to dampen the effect of sudden outside changes, like the change of the pressure in steam boilers, or a change of the chemical composition of the gas with gas engines, etc. The author deals especially with the second effect, with special reference to a former paper of Rosenberg.—*Elek. u. Masch.* (Vienna), April 4.

Losses in Induction Motors.—O. S. Brabstad and A. Fraenckel.—An illustrated translation in abstract of their recent German paper on an investigation and calculation of the "additional iron losses" in induction motors.—Lond. *Electrician,* April 2.

Lamps and Lighting.

Two-hundred-Volt Tantalum Lamp.—The 200-volt to 250-volt tantalum lamp has been placed on the market in England in 32-cp and 50-cp sizes, at a retail price of $1.25 each. The 32-cp lamps can be supplied in two types, "consuming 1.7 watts per British candle and 2.2 watts per British candle, respectively, the former at voltages from 200 to 250 and the latter only at from 200 volts to 230 volts." (The life of the two types is not stated.) The 1.7-watt lamps are 5 9/16 in. long and 2½ in. in

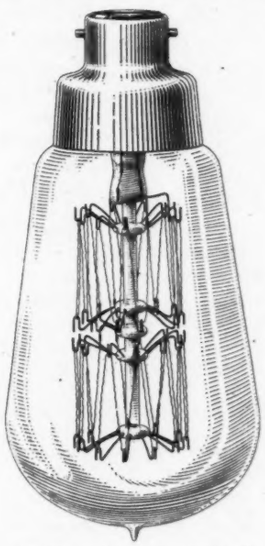


FIG. 2.—32-CP, 200-VOLT TANTALUM LAMP.

diameter, and the 2.2-watt lamps are 5 13/16 in. long and 2 15/16 in. in diameter. The 50-cp lamps are supplied only for the lower specific power consumption (1.7 watts per candle), and have the larger-sized bulb—5 13/16 in. long over the cap and 2 15/16 in. in diameter. The 32-cp, 1.7-watt lamps are recommended for use on direct-current circuits alone, whereas the 50-cp, 1.7-watt lamps and 32-cp, 2.2-watt lamps may be used on either direct-current or alternating-current circuits. The difference from the ordinary tantalum lamp is that the 200-volt lamp contains two filaments wound upon two sets of supporting arms instead of one, as shown in Fig. 2.—Lond. *Elec. Eng'ing,* April 8.

Metallic Filaments.—A note on a recent British patent of W. B. Coolidge, for the manufacture of metallic filaments (17,620, 1908; April 1, 1909). In the manufacture of filaments of tungsten and similar refractory metals, the squirted filament is cut into lengths, coiled and then baked in a vacuum or hydrogen chamber to remove the binding material. After this treatment the individual filaments are raised to a high temperature by sending current through them, in order to remove the last traces of the binder and to sinter the filament together. A difficulty in this last process was the fact that the filaments could not be connected in parallel, as some would take too much current and burn away, while others at the same pressure would not be properly sintered. To enable a large number of filaments to be sintered simultaneously the present invention provides for the use of a separate resistor with a high positive temperature-resistance coefficient, such as iron wire enclosed in a bulb filled with hydrogen, in series with each filament. The pressure can then be raised until every filament is properly sintered as a low-resistance filament will be prevented from taking too much current by the rise in resistance of the corresponding iron resistor.—Lond. *Elec. Eng'ing,* April 8.

Supports for Metallic Filaments.—A note on a recent patent of Siemens & Halske Company (21,385, 1908; March 25, 1909). Tungsten filaments are in some cases fused to the metal supports, which are then made of nickel or iron coated with copper. The nickel or iron forms an alloy with the tungsten at the point of fusion, and the copper is added to prevent trouble owing to the fusibility of the alloy when only nickel or iron is used. When the filaments are cemented only to the supports, or merely looped round the ends, it has been customary to employ supports of copper, as this metal does not retain occluded gases. According to the present invention, such copper supports are constructed with a core of steel to prevent them from softening with the heat and thereby becoming permanently deformed.—Lond. *Elec. Eng'ing,* April 1.

Incandescent Lamps.—G. Loring.—An illustrated Franklin Institute paper describing the procedure in manufacturing carbon-filament lamps and tungsten lamps.—*Jour. Franklin Inst.,* April.

Arc Lamp.—An illustrated note on the "Rebofa" flame-arc lamp, made by a British company. The electrodes are superimposed one above the other, the bottom electrode being the positive. The arc voltage is 30, so that six lamps may be connected in series for 200 volts. The electrodes are fed together by gravity, the top one being weighted.—Lond. *Electrician,* April 9.

Mean Hemispherical Candle-Power.—J. K. Sumec.—A brief illustrated article on the simplest methods for determining the mean hemispherical candle-power from the polar candle-power curve. If this curve is given, the mean hemispherical candle-power equals the arithmetical mean of the abscissas of those points of the curve which correspond to 10 deg., 20 deg., 30 deg., etc., below the horizontal, multiplied by $\pi/2$. (The right angle may, of course, be divided into any other number of equal parts instead of 10 deg.)—*Elek. und Masch.* (Vienna), April 4.

Generation, Transmission and Distribution.

Dalmatia.—H. Tenesel.—The conclusion of his profusely illustrated article in which a sketch is given of the development of the water-power of the Kerka River, in Dalmatia. The Manojlovac plant has a rating of 24,000 hp. Three-phase currents are used at 3000 volts and transmitted to a distance of 35 km (21 miles) for operation of 32 calcium-carbide furnaces. —*Elek. Zeit.,* March 25.

Electric Cranes.—H. H. Broughton.—A continuation of his long serial. In the present instalment the author deals with the design and construction of the mechanical equipment of cranes. The mechanism required for effecting the usual crane motions is treated in four sections. The first section relates to lifting mechanism. The article opens with a short discussion on the determination of the size of motor, and a simple expression is given suitable for most ordinary types of jib and overhead traveling cranes. Then follow notes on wire ropes, flat-link chains, the gear ratio, spur-and-worm gears, shafting, barrels, blocks and hooks, mechanical brakes, limit switches and the "free-barrel" system. Lifting magnets and safety tongs are also described.—Lond. *Electrician,* April 9.

Traction.

Surface-Contact System Abandoned.—The London County Council has decided to abandon the use of the "G.B." surface-contact system in the Mile-End Road. The highways committee stated the reasons for this action in a long report, which was adopted by the Council at about 4:30 in the morning, toward the close of an all-night sitting. In the course of the discussion, Mr. W. Thompson, who was chairman of the high-

ways committee, at the time the adoption of the "G.B." system was decided upon, expressed the opinion that the surface-contact system is to be the system of the future and that the "G.B." system had been "done to death by slanderous doings." The chief troubles experienced were due to the contact studs becoming alive from leaking of current, especially when the streets were wet and dirty. Some means of preventing this, however, have been recommended by Mordey. It has finally been decided to adopt the conduit system in that section where the overhead trolley cannot be used.—Lond. *Elec. Eng'ing*, April 8.

Melbourne.—An account of the report of C. Merz on the proposed electrification of the suburban railways of Melbourne, Australia. The following systems were compared: Unprotected and protected low-tension and high-tension third-rail systems, high-tension direct-current trolley system, three-phase system and single-phase system. The choice was narrowed down to a comparison of the unprotected third-rail, the protected third-rail and the single-phase overhead systems. Calculations showed that a protected third-rail system at 800 volts has many advantages over the unprotected system at a lower voltage, from both financial and operating points of view. It was further found that under Melbourne conditions the third-rail direct-current system shows a saving compared with the single-phase system. Concerning the power station, it is recommended that the prime movers be steam turbines supplied with superheated steam by water-tube boilers. The e.m.f. at the alternators is to be 12,000 volts; the switchgear is to be situated in a separate building, where the attendants are undisturbed by the noise of machinery or of accidents, and an elaborate telephone system is to connect the switchroom with each generating unit and with the substations. —Lond. *Elec. Review*, April 9.

Signal for Motormen.—All tramways in Liverpool are to be equipped with an automatic device by which a signal indi-

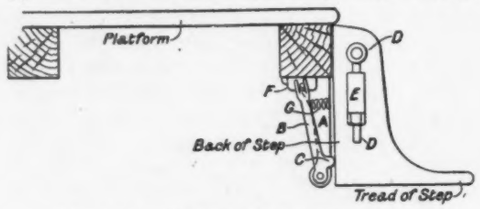


FIG. 3.—AUTOMATIC FOOT-BOARD SIGNAL.

cation is given automatically to the driver of a tramcar whenever a passenger attempts to board or alight from a car. The action of the device depends upon a contact being closed by the weight of the passenger as he places his foot on the step. The arrangement is shown in Fig. 3. At the back of the step a bracket *A* is fixed to the underside of the platform, projecting downward as far as the tread. Attached to the lower end of this bracket is a lever *B* having a projection *C* near the fulcrum against which the back of the step abuts. The step is hung on trunnions from adjustable hangers *D* passing through lugs *E* attached to the side frames and placed well back, allowing of slight swinging motion. When weight is applied to the tread this motion is communicated through the point *C* to the lever *B*, the top end of which is forked, and operates by a spring *C*. The circuit closed in this way lights a small lamp or operates the indicator placed on the top of the controller before the motorman.—Lond. *Elec. Eng'ing*, April 8.

Car Wiring.—An article on fire risks in heavy car wiring and control. The anonymous author points out the great objections from the fire-risk point of view in most of the systems at present for wiring railway motor-cars. Steel tubing is frequently used for protection, but there is much to be said against it. The author states that a far better result is obtained by the use of grooved slabs of asbestos slate. This system is used on the (London) Metropolitan Railway, but does not appear to have been adopted elsewhere to any great extent. In control apparatus preference is given to placing the whole of the apparatus in a fireproof compartment. Finally, it is suggested that aluminum might be used with advantage to a much larger extent than at present in car construction.—Lond. *Electrician*, April 9.

Installations, Systems and Appliances.

Electricity for Farms.—W. Siebert.—The author discusses the question whether direct current or three-phase currents are preferable for small electricity works in agricultural districts. Since motive power is the chief requirement and three-phase induction motors are of ideal simplicity, the three-phase system is preferred, especially as such small plants may be considered as possible substations of future large three-phase transmission systems. To store energy a battery may be provided with a synchronous converter. Parallel operation of the three-phase machines may be avoided by providing a special circuit for each machine and making provision so that any circuit may be connected to any machine. This system has proved quite successful on shipboard for ratings between 200 kw and 250 kw.—*Elek. Zeit.*, April 8.

Italy.—An article on the development of the electrical industry in Italy, giving general notes on large water-power stations, electric tramways and railways, and electric lighting plants, with special reference to the reasons why the German electrical companies have so far been predominant in Italy.—*L'Industrie Elec.*, March 25.

Tariff and Central-Station Economy.—Norberg-Schultz.—An illustrated description and abstract of his recent German paper in which the author endeavors to trace the effect of lowering the price per kw-hour. From curves relating to various stations he concludes that there is a critical price per unit below which the receipts per year based on the kilowatt of maximum demand fall off rapidly. The article has already been abstracted in the Digest.—Lond. *Electrician*, April 9.

Wires, Wiring and Conduits.

House Wiring—An illustrated description of a system of house wiring recently introduced by a British company. It involves the use of either of two systems, called the "stannos" and the "kuhlos." Kuhlos wires are made by wrapping plain or tinned brass or copper sheets around ordinary rubber-insulated conductors, the casing being finished off by bending

FIG. 4.—KUHLOS WIRE.

over to a longitudinal seam that projects somewhat from what is otherwise a smooth tube in close contact with the insulation. Continuity fittings and special wood blocks are provided. This system, which has been tried for some little time in Germany, affords a very inexpensive method of wiring with ordinary accessories, provided surface work alone is desired and the location is dry. A kuhlos wire is shown in Fig. 4. A feature of the wiring is the simple method adopted for fixing. Small clips, one of which is shown in Fig. 5, are nailed to the wall and then bent round the cable, as seen in Fig. 6. The cables can thus be rapidly fixed in position, and the cost of labor is reduced to a minimum. The clips are made in three sizes, for taking one, two or three wires, respectively. The cable can be bent by hand, so that bends, elbows, etc., are unnecessary. The

FIG. 5.—BUCKLE CLIP FOR ONE WIRE. FIG. 6.—WIRES FIXED WITH BUCKLE CLIPS.

stannos system is in principle the same as the kuhlos system just described, the wires being encased in tinned copper. This latter consists of a sheet of tinned copper, lapped twice round the cable, the second lapping being soldered thoroughly to the first. The cable is absolutely water-tight and can there-

fore be used in any situation. Two features are its great flexibility and the ease with which the metal casing can be removed for the purpose of baring the insulation. Owing to their small diameter (a 3/20 stannos wire is only 0.196 in. diameter), the wires are particularly suitable for locations where value is attached to neat appearance. In order to ensure continuity, special continuity fixtures are provided. These fixtures comprise back-plate, spring-plate or clamp, and special wood block. The metallic parts are made of sherardized steel, so that it is impossible for rust or verdigris to form and so cause the contacts to fail. It is claimed by the British company which has introduced this system that the stannos can easily be installed at less than $2.50 per point, including a carbon lamp. The kuhlos system is even cheaper, although not so pleasing.—Lond. *Electrician*, April 9.

Electrophysics and Magnetism.

Frictional Electricity.—M. OWEN.—An account of experiments the object of which was to obtain curves showing the electricity charge produced as a function of the work expended in friction. Specimens of ebonite and glass were rubbed on a slate wheel, the axle of which was connected to earth. In some of the experiments the rim of the wheel was covered with a band of copper. Measurements made with specimens of different widths showed that the charge produced by a given amount of frictional work was almost exactly proportional to the width of the specimen, except in the case of very small amounts of work. The curves show that with a sufficient amount of frictional work the charge produced reaches a constant maximum value; that this maximum is independent of the pressure applied during the rubbing, but that the maximum is reached with a smaller quantity of work the greater the pressure. The view generally held as to frictional electricity is that due to Helmholtz, namely, that it is of the nature of contact electricity, the frictional work being expended in bringing the surfaces into closer contact. This view appears to be borne out by the observation that after a number of preliminary rubs the maximum deflection may be obtained with quite a small amount of frictional work, an amount much less than that required to give the maximum charge with the first rub. During the three or four hours' rest it might be supposed that the surface of the specimen goes through a process of slow elastic recovery of its original uneven form, or that during this time the surface becomes tarnished by the atmosphere, so that after this period the first contact is not a good one. However, in no case, whether after recent rubs or not, did mere contact of the wheel and specimen without rubbing produce even the slightest evidence of charge on the specimen.—*Phil. Mag.*, April.

Crystal Rectifiers.—G. W. PIERCE.—An account of an investigation of crystal rectifiers for electric currents and electric oscillations. In the present paper the author deals with carborundum, molybdenite, anatase and brookite. The rectification is conditioned on the localization of the energy of the circuit at the high-resistance boundary between the two different classes of conductors, the crystal and the metallic electrode. Such a localization of energy at the boundary of the two conductors is favorable to the production of electrolytic polarization, if electrolytic polarization may exist in solids, and is also favorable to the production of a thermo-e.m.f., either of which might result in rectification. However, some experiments of the author appear to indicate that neither electrolysis nor thermoelectricity plays an important part in the phenomenon.—*Phys. Review*, March.

Theory of Radiation.—A. EINSTEIN AND J. WEISS.—Two highly theoretical papers. Einstein discusses critically some important fundamental points in the modern radiation theory. He endeavors to show that the Jeans-Lorentz radiation law is a necessary consequence of the statistical theory of heat; but he agrees with Planck that the above law is not in agreement with the facts. He then endeavors to show that Planck's radiation theory contains a certain intrinsic imperfection on account of not sufficiently defining the conception of probability. He then shows how it is possible, by modifying the foundations of Planck's theory, to reach the same results as Planck's with absolute strictness. J. Weiss gives a brief derivation of Planck's radiation law and shows why Jeans' argumentation, when translating simply the formulas of the gas theory to the electromagnetic parameters, leads to wrong results.—*Phys. Zeit.*, March 15.

Properties of Matter.—J. J. THOMSON.—An account of his concluding three lectures before the Royal Institution, in London, on the properties of matter. The author discusses gravity, elasticity and surface tension.—Lond. *Electrician*, April 9.

Units, Measurements and Instruments.

Weston Cell.—F. A. WOLFF.—An abstract of an American Physical Society paper in which the author deals with the value of the Weston cell obtained immediately after it is completed by bringing the mercury into contact with the paste, and furnishes a crucial test of the theory regarding the equilibrium conditions in the cell recently advanced by Hulett. The behavior to be expected on the theory proposed by Hulett was not found, so that it may be concluded that the assumption of accelerated hydrolysis at a mercury surface does not apply to the Weston cell as ordinarily set up.—*Phys. Review*, April.

Thermoelectric Couples.—W. W. COBLENTZ.—An abstract of an American Physical Society paper on the thermoelectric behavior of tungsten and tantalum. Further improvement in the construction of thermopiles must come through the reduction of the heat capacity of the junctions. Tantalum is obtainable in fine wires; it is pliable and does not oxidize readily at ordinary temperatures, and hence, suggests itself as a substitute for iron (steel) in connection with constantan. Observations were made on the thermoelectric force of couples made of copper-tantalum and copper-tungsten, the temperature range being from -180 deg. C. to $+300$ deg. C. The results show that throughout the range investigated the thermoelectric force of the copper-tantalum couple is about 4.1 microvolts per degree, which is one-tenth that of a copper-constantan couple. The thermal e.m.f. curve of tungsten-copper is rather unusual in that its inversion temperature occurs at about 40 deg. C. For temperatures below -100 deg. C. the thermoelectric force is about 3.8 microvolts per degree, while above $+200$ deg. C. the thermoelectric force is about 4.5 microvolts per degree. In each couple the direction of the current is the same as that in a copper-constantan couple.—*Phys. Review*, April.

Moving-Coil Galvanometer.—A. ZELENY AND O. HOVDA.—An account of an experimental investigation of the temperature coefficients of the moving-coil galvanometer. The moving-coil galvanometer has three temperature coefficients: one each for current, potential and ballistic measurements. On account of magnetic hysteresis and other disturbing causes it was found impossible to determine the values of these coefficients for an individual instrument with as high a degree of precision as it is possible to read deflections or throws. The values of the coefficients for different galvanometers of the same construction and materials are found to differ considerably, so that only approximate values can be given for any type of the instrument.—*Phys. Review*, April.

Alternating-Current Meter.—An official announcement of the Reichsanstalt by which induction meters for single-phase current and for three-phase currents, with a balanced load, are admitted for calibration. The constructions of the meters are described and illustrated.—*Elek. Zeit.*, March 25.

Tests of Steel.—B. O. PEIRCE.—An article describing a long series of determinations of the permeabilities of normal brands of compressed steel, Bessemer steel and Norway iron, in the form of ½-in. rods, over a wide range of excitation, and considering especially a method of measurement in a massive yoke in the region from $H = 400$ to $H = 2500$, which lies above the limits of most permeameter observations and below those of the isthmus method.—*Am. Jour. of Science*, April.

Telegraphy, Telephony and Signals.

Effect of Daylight on Wireless Telegraphy.—MOSLER.—Marconi has found that wireless messages can be transmitted to much greater distances at night than during the day. He believed that the smaller effect during the day was due to sunlight

dissipating the negative charge of the antenna of the transmitting station. The present author has measured the damping effect of the antenna at different times of the year and at different hours of the day, and has found that the damping effect is the same during day and night. He has further found that for transmitting messages to distances of 300 km (180 miles) the energy arriving at the receiving station is exactly the same during day and night. Marconi's observation cannot be explained, therefore, by a photoelectric effect of sunlight on the transmitting antenna. It must be assumed that in the long-distance transmission experiments from the Poldhu station the radiation was propagated in high altitudes of the air, and the final cause of Marconi's observation must be found in ionization.—*Elek. Zeit.*, April 1.

Miscellaneous.

British Patent Law.—Delivering a judgment in an appeal against a decision of the Comptroller-General of Patents, revoking a patent under the new British patent act, Justice Parker discussed what, in his opinion, was the intention of the legislature under the revocation clause, and also criticized the rules under which applications for revocations have to be made. His view as to the desirability of alteration in the present procedure is opposed to that expressed by the Comptroller. While the patent in question is not an electrical one, the following remarks of the judge (who had also to do with the recent Bremer arc-lamp patent revocation) are of general interest. In his opinion, it was wrong for the applicant not to be compelled to give evidence and satisfactory reasons for applying for the revocation of a patent. At present the patentee would be forced to disclose valuable information, the possession of which might be the precise object of the applicant, who, having obtained it, could withdraw his application for revocation. It allowed competitors, or intending competitors, to obtain particulars of the patentee's business which they otherwise could not obtain. Therefore, every applicant should be forced to give some *prima facie* evidence that his statement was correct. Reasonable protection should be given to the patentees; even a common informer had to make out some case requiring an answer, and it was obviously wrong that an applicant for a revocation of a patent should be freed from this obligation. Referring again to the Bremer case, Justice Parker stated he had come to the conclusion that both parties in an appeal must be compelled to rely upon the case which they placed before the Comptroller. In other words, he would not allow extra evidence to be called. He allowed this procedure in the Bremer case owing to the fact that he himself had not fully considered this point and felt that the patentees in that action might be in the same position.—Lond. *Elec. Eng'ing*, April 1.

Carbon-Tungsten Steels.—An account of the quite extended discussion which followed the recent paper of T. Swinden on the magnetic properties of a series of carbon-tungsten steels. J. W. Ullet said that manufacturers of telephone apparatus find that the question of the permanence of magnets is a very important one. Careful investigations have shown that a gradual drop in the strength of a receiver magnet makes a very considerable difference in the efficacy of the receiver. One speaker had referred to the excellent results obtaind by sparking magnetos of high-class construction, such as the Simms-Bosch. Ullet was not quite sure that the efficacy of these instruments is due entirely to the strength of the magnets. The excellent accuracy of the work is a more important factor. In reply to a question of McWilliam, Swinden said that he had not yet found either carbon or carbon-tungsten which was non-magnetic. The only reason which would lead one to the belief that a purely austentic steel would be non-magnetic (assuming that such a steel could be obtained) are that (1) the magnetic strength decreases as austenite appears and (2) the "artificial" austenite produced in nickel and manganese steels, which resemble very closely the austenitic constituent of quenched high-carbon steels, is practically non-magnetic. With regard to the maximum permanence value with a carbon content of only 0.5 per cent C, this is due to the permanence being a resultant effect of coercive force and remanent intensity. Although the higher (6 per cent) tungsten steel is now preferred in practice, it is possible that by judicial treatment the 3 per cent steel can be made to compete.—Lond. *Electrician*, April 2.

Argentina.—A statistical article on electrical imports to Argentina during 1907. Among countries exporting electrical machinery, etc., to Argentina, Germany is first, England second and the United States third. The chief items imported are wires and cables.—*Elek. Zeit.*, March 25.

BOOK REVIEW.

Vectors and Vector Diagrams Applied to the Alternating-Current Circuits. By William Cramp and Chas. F. Smith. New York: Longmans, Green & Company. 252 pages, 114 illustrations. Price, $2.50.

The title of this volume is quite misleading because it deals more largely with algebraic and symbolic, than with the graphic, representation of the relations in alternating-current circuits, while in four of the 10 chapters there are fewer vector diagrams than the average writer would use in treating the subjects covered, namely, self-induction and mutual induction, the transformer, motors of the induction type and alternating-current commutator motors. The remaining six chapters deal with vectors and with locus diagrams, but the diagrams actually shown have been used for interpreting certain equations rather than for showing physical relations directly. The book may be considered as giving a mathematical treatment of the more prominent electromagnetic phenomena with the aid of vectors, the uses of which are explained, and as such should be of value as a textbook for electrical engineering students.

NEW APPARATUS AND APPLIANCES

Boulton Shops of the Richmond, Fredericksburg & Potomac Railroad Company.

An excellent example of the change from steam to electric drive is furnished by the Boulton shops of the Richmond, Fredericksburg & Potomac Railroad Company, at Richmond, Va., familiarly known as the "Washington-Richmond Line," as it runs from Washington, D. C., to Richmond, Va. The maintenance of the rolling stock and the manufacture of both freight and passenger cars are carried on at these shops. A three-phase, 220-volt, 60-cycle system of distribution is employed with constant-speed induction motors.

The original electrification was begun about six years ago by the installation of a 75-kw belted generator, which was used only for lighting purposes, and about one year later a 125-kw Westinghouse generator was added to supply power for the machine shop. This is in use at present and is driven by a Ball engine of 225 hp direct-connected to the generator. Upon the erection of a new planing mill it was necessary to replace the 75-kw generator by one of 150 kw to drive the wood-working machines. This latter generator is direct-connected to a Ball engine of 250 hp. The generators are excited from a 17½-kw, 125-volt, direct-current Westinghouse generator driven by a Troy upright engine. The larger generating unit and the exciter are shown in Fig. 1. Steam is supplied from two locomotive-type boilers at 125-lb. pressure. The switchboard represents standard Westinghouse practice for low-tension, three-phase, alternating-current circuits.

The entire electrical equipment was installed by the local

operating force of the company under the direct supervision of Mr. W. F. Kapp, superintendent of shops and machinery. From the time of the original installation no interference whatever has been experienced by the failure of any of the power-plant equipment or the motors. The only interruption of service which has occurred has been the occasional blowing of a fuse when some one of the motors was started improperly.

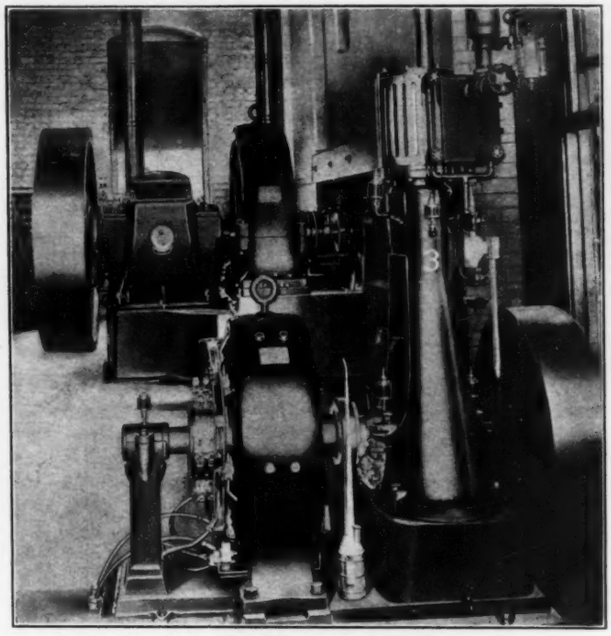


FIG. 1.—GENERATOR AND EXCITER.

The machine-shop equipment is particularly well arranged both with respect to the machines and the driving motors and the natural lighting facilities. Several of the individually driven machine tools are shown herewith, clearly indicating the convenience of the motor drive as well as the general cleanliness of the shop, as a result of the elimination of a large part of the belts. The table on page 1044 shows the different equipments used in the shops, including the wood-working department, the machine shop, the wheel-mounting shop and the blacksmith shop. In addition to the equipment shown in the table should be mentioned a storehouse elevator, operated by a 10-hp induction motor, and a Sturtevant fan in the punch shop for use in connection with the heating system, driven by a 10-hp motor. The heating of the paint shop is done by a 50-in. fan and heater coils, which are located in the roof trusses, the fan being operated by a 7½-hp motor.

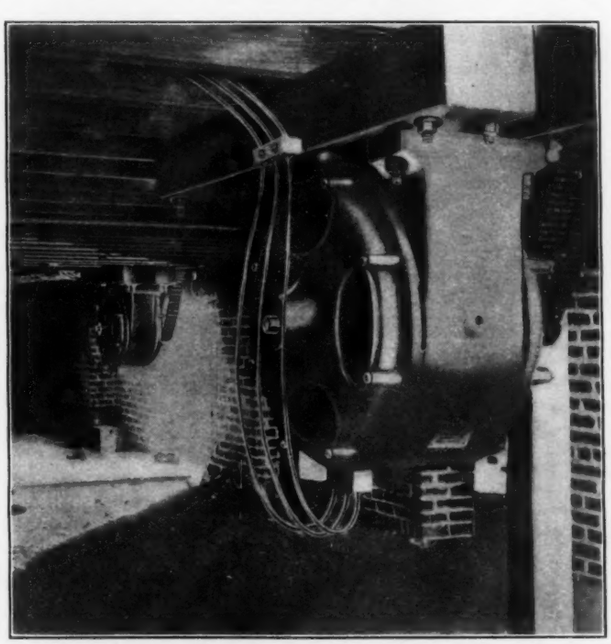


FIG. 2.—MOTORS ON UNDER SIDE OF FLOOR OF PLANING MILL.

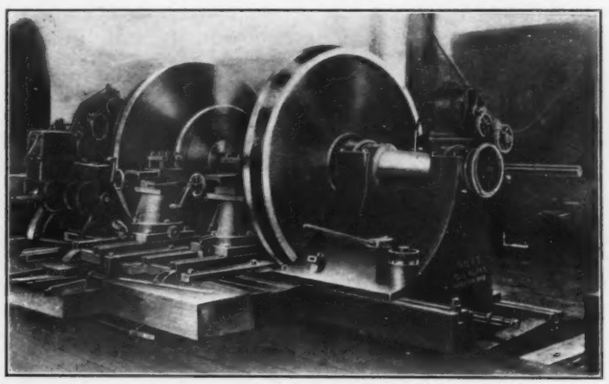


FIG. 3.—DRIVING-WHEEL LATHE—90 IN.

In connection with the installation of the 40-hp motor driving the two boring mills, the wheel press and the double-head axle lathe in the wheel-mounting shop, it should be noted that the original intention was to drive the entire machine-shop equipment from this one motor, but circumstances allowed such a regrouping of the tools that this motor became available for its present work. It has ample capacity to allow considerable expansion in this department when such proves to be necessary.

In the machine shops the line shafts of the group drives present an unusual feature in the high speed at which they run. Standard practice usually gives a maximum line-shaft speed of approximately 200 r.p.m., but here one shaft runs at 400 r.p.m. and the other three at 300 r.p.m. No trouble whatever has resulted from these unusual speeds.

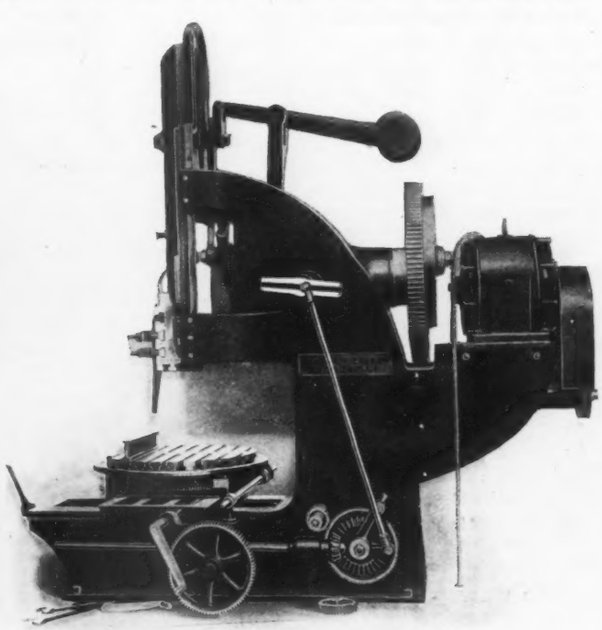


FIG. 4.—SLOTTER.

The planing mill is especially interesting owing to the manner of mounting the motors. In the extension of the shop plant it became necessary to fill in to a considerable depth the ground

on which the planing mill is situated in order to bring the floor level up to a grade. It was decided not to fill in the space immediately beneath the building, but to leave this portion in the shape of a basement, utilizing the space to mount the motors and such shafting as are necessary to operate the various machines. The motors are suspended from the lower side of the floor beams and connected to the machines or shafting which they operate by means of a flexible chain; the method of support is clearly shown in Fig. 2.

This solution of the motor-drive question has resulted in a planing mill which is practically free of obstructions with the exception of the tools themselves and such material as may be in process of manufacture, the only motors above the floor

BOULTON SHOP EQUIPMENT OF RICHMOND, FREDERICKSBURG & POTOMAC RAILROAD.

Driven Machine Kind	Size	Manufacturer	Motor H.P.	Drive	Location
Planer	36″x11″	Niles-Bement-P'd.	7½	Individual.	Machine shop.
Driv'g-wh'l lathe.	90″	Niles	20	"	"
			3	"	"
Shaper	24″	Bement-Miles Co.	7½	"	"
Boring mill, horiz.	...	Niles	3	"	"
Planer, Wheel press, Drill press	...	...	10	Group	"
Boring mill	44″				
Lathe	35″	...	15	"	"
Lathe	24″				
Guide grinder	...				
Lathe	43″				
Lathe	24″				
Turret lathe	13″	...	10	"	"
Drill press	...				
Emery grinder	...				
3 lathes	24″	...	5	"	"
Punch and shear, 2 bolt threaders, Grindstone	...	Hilles & Jones	7½	"	Blacksmith shop.
Bolt header	1¼″				
Drill press	34″	...	10	"	"
Pipe threader	4″				
2 tool grinders	...	...	3	"	Tool room.
Fan	30″	Sturtevant	3	Individual.	Blacksmith shop.
2 boring mills	44″				
Double head axle lathe	...	...	40	Group.	Wh'l m't'g shop
Wheel press	250 tons				
Tool grinder	24″				
Flue tumbler	200 flues	...	10	Individual.	...

PLANING-MILL EQUIPMENT IN RICHMOND, FREDERICKSBURG & POTOMAC SHOPS.

Woodworking Tools Kind	Size	Manufacturer	Motor H.P.	Drive
Bandsaw	42″	Fay & Egan	7½	Individual.
Car sill tenoner and gainer	12″	" " "	7½	"
Cut-off saw	40″	Greenlee	15	"
Four-side molder	10″	...	20	"
Double cabinet-makers' saw	24″	Greenlee	15	"
Universal planer	12′x30″	S. A. Woods	40	"
Jointer	24″			
Double-head shaper	...			
Lathe	20″	...	20	Group.
Sash sticker	...			
Jig saw	...			
3 tool grinders	...			

being the one on a traversing-bed planer, as illustrated, which is driven by a 10-hp Westinghouse induction motor mounted directly on the machine; and one above the floor line driving the fans which take care of the shavings, this being situated in the roof trusses. The blast and exhaust pipes drop from the trusses directly to the machines which they serve.

The refuse from the machines is collected by means of a 50-in. fan and driven to the boiler-room where it is consumed by means of a second 50-in. fan. Both fans are driven by a 40-hp induction motor.

The entire electrical installment was made with Westinghouse Electric & Manufacturing Company apparatus.

Screw Guy Anchor for Pole Lines.

There are many conditions met with in the construction of electric light, telephone and street-railway pole lines that call for ingenuity on the part of the man in charge in obtaining suitable anchorages to counteract side strains on the line. W. N. Matthews & Brother, St. Louis, Mo., claim that by means of the Matthews guy anchor many otherwise impossible situations may be overcome, owing to the fact that it may be screwed into the ground without digging, and that it will hold very great strains. Fig. 1 shows one of nine poles in a curve in an important feeder line owned by the Union Electric Light & Power Company, of St. Louis, running along Broadway past Calvary Cemetery. The pole line is located just inside of where the curbstone will be located when the street is finally paved. There is a cinder sidewalk between the pole line and the fence shown in the picture. This line had to be anchored, but as authority could not be obtained from the owners of the cemetery to put "deadmen" in their grounds, ways and means had to be devised for overcoming the difficulty involved, and to

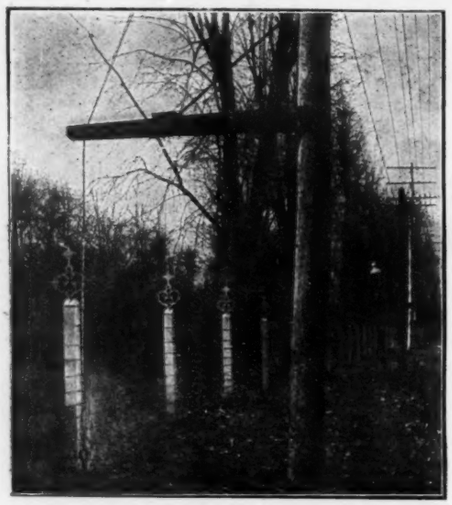


FIG. 1.—ANCHORED POLE ON A CURVE.

obtain an anchorage that would not interfere with pedestrians. The method by which this obstacle was overcome is shown in the illustrations. An arm was built out from the pole about 12 ft. above the ground. The guy wire was brought out to the end of it and then secured in a vertical position to an 8-in. anchor, which was screwed down to the eye alongside of the fence posts. It can readily be seen that under these conditions it would have been impracticable to put in a deadman or any other form of anchorage depending on a solid bank of earth for its support. Fig. 2 shows a crew of the Union Electric Light & Power Company installing a 6-in. guy anchor at an angle which brings it under a granitoid sidewalk. If a deadman had been used in this case, it would have been necessary to take

FIG. 2.—PUTTING GUY ANCHOR IN PLACE.

up two squares of granitoid to dig the necessary hole, and the cost would have been excessive. The electric light company has used a number of these anchors in St. Louis for dead-ending leads going through alleys. All of the alleys are paved with brick on top of concrete, and it has been found very economical to use anchors of the type described because it is only necessary to remove 8 in. to 12 in. of brick and concrete until the solid ground is reached, and then screw the anchor to place. Where it is necessary to obtain the permission of

property owners for the installation of an anchorage in their lawns, it is not difficult to get them to consent to the use of an anchor that does not require the digging of a hole and whose installation does not disturb the property in which it is installed. The anchor can also be used to advantage in low-lying ground that is covered with 2 ft. or 3 ft. of water or marsh, as it can be screwed down into the solid ground beneath and a good permanent anchorage obtained without the necessity of constructing a box to keep out the water and silt before a hole could be obtained to bury a deadman.

New Keystone Switchboard Instruments.

Some new round-pattern switchboard instruments have recently been put on the market by the Keystone Electrical Instrument Company, of Philadelphia, one of which is illustrated herewith. These are designed for both alternating- and direct-current measurements, and have, it is claimed, some very desirable features embodied in their construction. They are very strongly built and will, it is claimed, stand the worst kind of abuse without injury; 100 per cent overload can be applied at the instrument terminals without bending the needle or permanently injuring the movement. All parts are generously proportioned and a powerful torque is produced without introducing temperature errors or increasing the current consumption of the instrument. The opening in the instrument case over the scale is large so as to admit plenty of light, thus facilitating readings at a distance. The scale markings also are clear and distinct.

ROUND PATTERN SWITCHBOARD INSTRUMENT.

In the opinion of many engineers an instrument void of all useless ornamentation harmonizes better with the other equipment in a modern switchboard, so for this reason these new instruments show merely a border and the necessary lettering. The standard finish is dead black, but any other style of finish is supplied when requested.

New Appliances at Iowa Convention.

The exhibits made at the convention of the Iowa Electrical Association and the Iowa Street & Interurban Railway Association, at Cedar Rapids, were so extensive as to comprise a good-sized electrical show. The American Auditorium was rented by the association and the entire main auditorium room was offered to exhibitors and completely occupied by them free of expense for exhibit space. The original plan was to hold the convention in the center of the auditorium with the exhibits around the walls, but the requests for space were so numerous that the entire floor was taken up finally and the convention sessions held in an adjoining room. The plan is one which was much appreciated by the supply men, many of whom made exhibits when they otherwise would not have done so. The plan of renting parlor space in hotels at State conventions has never been very satisfactory, because of the high prices charged and the out-of-the-way location of many of the rooms in the average hotel. In the following paragraphs it will be impossible on account of lack of space to mention all of the exhibits, but attention will be called to some of the newer appliances which have not been on the market long and which are, therefore, of special interest to central-station men who wish to keep posted on the latest appliances.

The Pacific Electric Heating Company exhibited in the booth of J. B. Terry & Company, local Cedar Rapids dealers, some of the new "hot-point" irons, which have an automatic attachment whereby the plug is thrown out and the iron disconnected when a certain temperature is reached. This automatic protection, which not only reduces the fire risk, but prevents waste of energy when the iron is forgotten with the energy turned on, has proved so popular that factory facilities have been taxed to supply it.

The Railway Specialty & Supply Company, of Chicago, exhibited a vacuum-cleaning machine made by Hanlon & Wilson. The outfit exhibited had a ½-hp motor belted to a rotary pump. It is of a size convenient for movement from one room to another or from house to house.

The Fort Wayne Electric Works, in the way of new appliances, exhibited its "Compensarc," which is a kind of transformer for reducing the voltage from 110 volts to that required by the arc of a moving-picture apparatus. It can be connected for a 14-amp, 40-amp or 60-amp arc.

The Duncan Electric Manufacturing Company had on exhibition its new portable recording watt-hour meter for use in testing consumers' meters. This has a push-button pointer resetting appliance whereby the pointers can be returned to zero at any time for convenience in starting a test from zero. This instrument also has a dial switch for quickly changing from 110 volts to 220 volts or from 5 amp to 40 amp maximum capacity, which is a great improvement in speed over the old plug method.

The Central Electric Company had the only exhibit of 5-watt, 4-cp, 10-volt tungsten sign lamps. These were on a sign operated from a Central Electric step-down transformer reducing from 110 volts to 11 volts. A new Central Electric time-switch, which sells at a very reasonable price, was also shown. On this time-switch a common alarm clock trips a trigger operating a common rotary snap switch. The "Central" vibrator was another new specialty shown, as was also a remote-controlled switch for 25-amp capacity. These remote-controlled swithes obviate the necessity of running heavy main feeders long distances where the point of control has to be some distance from the natural course of the wires from the service entrance of the building. The high-tension drop-out strand protector which, when placed at each end of any span, will completely disconnect any span in which a break should occur, has been recently brought out in copper, and at the Iowa convention was also shown in aluminum for use with aluminum transmission lines. Other new specialties were the "tungstometer," a small instrument for measuring the wattage of tungsten lamps; "Opalux" white reflectors for tungsten lamps and Pelouze electric irons, which are of unusually high efficiency.

The new General Electric flatiron, regarding which announcement was very recently made, was exhibited for the first time. The heating, or resistance, metal in this iron consists of a single layer of flat metal stamped from a sheet in zigzag form. This is placed between mica sheets and is clamped between the bottom of the iron and another piece of iron above the resistor which acts to supply heat storage. Between the top of the iron and the heat-storage piece is an air space, which acts as a non-conductor of heat to prevent unnecessary loss by radiation from the top of the iron. The notable feature of this heating element is that a resistance metal has been found which is of such high specific resistance that only one layer need be used. This layer can be placed between thin mica sheets so that the heat passes readily into the iron above and below, thus providing for conductivity of heat away from the resistance metal, this being necessary to prevent the destruction of the resistance metal in any heating element. The new iron has also another important improvement in the terminal which makes it impossible to attach the plug to the iron incorrectly,

as in the former types. This should materially assist in eliminating cord and terminal troubles, which have been common. A transformer employing a new shape of core and a new alloy steel which reduces core losses were a part of the General Electric exhibit. A mercury-vapor rectifier set for electric automobile charging was also shown.

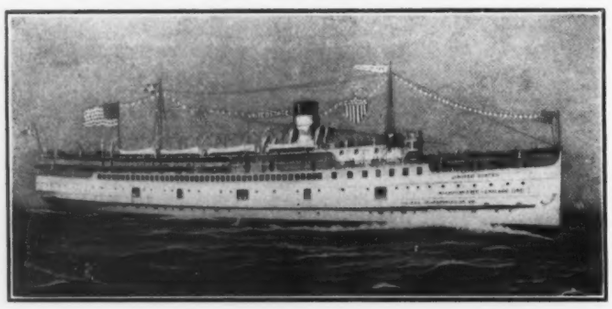
The Westinghouse Electric & Manufacturing Company has recently brought out a new toaster which has some strong points. It consists of a flat Hadaway heating unit placed horizontally. To make toast, a wire netting is placed over this unit to bring the toast a short distance from the metal of the unit. The toaster can also be used as a stove or griddle by placing over it a flat iron plate instead of the wire netting. The device has a handle which can be used for moving the toaster when it is hot, or can be pulled out and used as a toast or griddle-cake turner. The legs are removable and have smooth bottoms which will not scratch polished tables. The new Type S transformer, with low core loss, employing the new steel and the new form of core, was shown. The Westinghouse portable recording watt-hour meter for testing and calibration of consumers' meters has been improved by substituting a rotary switch for the plugs formerly used to connect the meter for different current-carrying capacities. It has been found that these plugs are likely to get lost, so that this rotating switch has been provided. The switch also gives a much more rapid means of changing the meter to carry different loads. A chocolate-heater for candy factories was one of the recent electric heating appliances much appreciated by local candy men who visited the exhibit.

The Federal Electric Company displayed several new types of tungsten clusters.

The General Compressed Air & Vacuum Cleaning Company, of St. Louis, which has been in the vacuum-cleaning business for a number of years, making large machines, now manufactures a small machine employing a ½-hp motor. This machine is of such weight and size that it is easily moved about a house by one person.

New Lake Steamer Brilliantly Illuminated.

Chief among the novel and interesting features of the new steel lake and ocean steamer *United States*, which goes into commission this month on Lake Michigan, is its electrical equipment. In addition to the regular lighting, the steamer bears an immense shield decorated with red, white and blue lamps; a large skeleton star outlined with electric lights and a huge double-face electric sign reading "United States." This sign will flash the name of the vessel first on one side and then on the other. The crowning feature, however, is the electrical flag erected on the stern. This is constructed entirely of metal and is studded with red, white and blue electric lights which are arranged



STEAMER "UNITED STATES."

with a flasher giving the effect of a waving flag. To see the Stars and Stripes waving at night miles out on the lake will be, to say the least, an unusual sight. The flag, star, name-sign and shield are connected with festoons in the three colors extending from the masts. All of the electrical features were manufactured in the shops of the Federal Electric Company, Chicago.

Each of the 46 staterooms of the steamer bears the name of one of the States of the Union; special panels between the staterooms display the portraits of the present Governors of the States, and there is a gigantic wooden map of the United States made up of blocks of wood gathered one from each of the States of the Union, kiln-dried and then highly polished to show their natural grain. Each block is carved in the exact geographical shape of the State from which it came, so that when put together they form a complete map of the nation. The walls of the cabin are filled with oil paintings portraying the most striking events of our sea history.

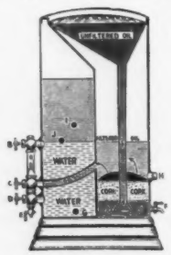
The *United States* is 215 ft. in length, 40 ft. beam and to the top of the bridge measures 56 ft. It is equipped with the most complete wireless telegraph apparatus to be had in this country.

Phantom Loads for Testing Alternating-Current Meters.

A portable loading device for alternating-current meters, shown below, has recently been placed on the market by H. J. Blakeslee, of Syracuse, N. Y., which is especially serviceable for central-station meter departments. The apparatus consists of a shunt transformer with low-voltage secondary and current-controlling arrangement. In use, the current coils of the meter under test and the standard are supplied from the transformer secondary and the potential coils are connected as normally. When a test of a meter is made in this manner, by exciting the current coils from a separate low-voltage source, an artificial load is created which is only apparent, and the load indicated by the instruments does not actually exist. Three requirements are said to have received particular attention in the design of the device. In order to insure that when in use the instruments shall be operating under conditions which are equivalent to those of a normal test and all objections as to power factor and varying or abnormal wave forms eliminated, a shunt transformer is used with constant-core magnetization, and a regulating resistance is used only in the secondary. To provide wide range and accurate adjustment of current, the resistance is arranged so that although nothing smaller than No. 4 wire is used, any current value from zero to the maximum can be obtained. The instrument has been made singularly compact; that rated at 150 amp having dimensions of 5 in. x 5 in. x 4 in., which permits it to be readily placed in one corner of an inspector's grip.

Oil Filter.

The accompanying illustration shows the details of an oil filter manufactured by the Kosmic Oil Filter Company, of Easton, Pa. Several advantages are claimed for the arrangement shown. Clarification takes place from below upward, and not by filtration from above, downward. The filter is divided into two compartments, enabling one compartment to be cleaned without interfering with the other. By regulating the valve which controls the flow of oil from one compartment to the



OIL FILTER.

PORTABLE LOADING DEVICE.

other, the degree of purity can be seen as the oil passes through the water in the gage glass, and the process can be regulated to the purity of the oil desired. Unfiltered oil is poured in the top over a screen *A*, and passing down is constrained to pass upward again through the cork and screen. The oil then passes over the connection shown and up through the glass filled with water, and out into the storage chamber. The clean oil may

be drawn off through the cock *I*. Before the filter is ready for operation water is poured into it until it emerges at the cock *J*. When it is desired to clean the filter, the valve *C* is closed and the oil drawn off from the spigot *F*. Hot water is then poured in the top of the filter and the interior rinsed out well. By opening the spigot *F* and removing the cap *H*, water and dirt may readily pass out. This operation may be repeated several times if necessary, when the spigot *F* may be closed and the cap *H* replaced. The filter is then again ready for use. Any water contained in the oil may be drawn off from time to time through the spigot *F*. The filter is built in two sizes, one capable of filtering from 20 gal. to 40 gal. in 24 hours and the other large enough to filter 10 gal. to 20 gal. in 24 hours.

Chicago Electric Washer and Wringer.

One of the most pleasing characteristics of the electrical advancement of the twentieth century is the new and varied applications of electric motors by which the drudgery of household work is lifted from the shoulders of women. Washing machines and wringers, for instance, are now successfully operated, and their use promises to rob "wash-day" of its terrors. The Hurley Machine Company, of Chicago, manufacturer of the "Thor Electric" washing machine, has introduced a new

ELECTRIC WASHER AND WRINGER.

and simple type, which it calls the "Chicago" electric washer and wringer. This outfit is illustrated herewith. A small motor is attached under the washtub so that it may be connected by belt-drive either to the washing machine or the wringer, as shown in the picture. Electricity may be obtained through a plug attached to any lamp socket, and either alternating- or direct-current motors may be used. The combination is strong and compact, with few parts to get out of order. The tub is built of cypress, said to be the best wood obtainable for this purpose, and it has a corrugated bottom and sides, giving it a washboard surface. The cover is made double, so that it will not warp, and it is so constructed that it may be raised at any time without turning off the power. All that is necessary is to partially fill the machine with soapsuds, place the clothes in it and turn on the current. The new machine is introduced as a practical, low-priced piece of apparatus, and the company offers to put it in for free trial. The wringer furnished with the machine is specially devised for this use, and can be started or stopped by the touch of a button.

Ampere-Hour Meter.

The accompanying illustrations show two types of amp-hour meter recently brought out by the Sangamo Electric Company, of Springfield, Ill. While such a meter is especially serviceable for electric vehicles, train-lighting equipments, central-station batteries, and was, in fact, designed primarily for use in connection with storage batteries, it is applicable for a number of other uses. One use to which it has been adapted since its introduction is in connection with electroplating operations, the meter being calibrated to read in quantities of metal deposited instead of amp-hours. Fundamentally, the meter does not differ from the well-known Sangamo direct- and alternating-current mercury, motor-type watt-hour meters. In these meters a copper-disk armature is immersed in mercury contained in a mercury cup or chamber so constructed as to prevent spilling or escape of mercury in any position in which the meter is placed. Contacts are embedded in the walls of the mercury chamber so that current may be led in and out through the mercury and the armature. When the current passes across the magnetic field, a stress is exerted upon the conductor carrying the current tending to displace it.

In the service type of meter shown herewith it will be noticed that the tips of the poles of the mercury chamber are attached to the poles of a large energizing magnet. The armature immersed in the mercury is subjected to a powerful field on each side of the center. The magnet takes the place of the potential-energizing coil and field used in the standard type of Sangamo direct-current meter. When the current passes through the armature and across the two field coils, a rotative effect or torque is exerted upon the armature which varies with the current passing, the fields remaining constant. Like the watt-hour meter, the amp-hour meter is operated with current shunts. The standard meter without shunt is rated at 10 amp. and in this size the entire line current passes through the arma-

FIG. 1.—"AUTO" TYPE, WITH CASE REMOVED.

ture, the meter being capable of taking an overload of 100 per cent. In larger sizes the armature is shunted; the shunt across the main binding posts of the meter being placed inside the meter up to 100 amp, and external to the meter in larger sizes. The meter is said to be remarkably accurate, owing to a special arrangement of armature, damping disk and permanent magnet. The recording train and dial differs from that in the watt-hour meter, the purpose of the dial being to show at any time by the position of a single pointer the condition of the battery with which the meter is connected. As the pointer will rotate backward on charge at exactly the same rate that it rotates forward on discharge, it acts as an indicator to show when a battery is fully recharged for partial or complete discharge. Thus, if the meter indicates a discharge of 60 per cent of the total rated capacity, the charging current would be kept on until the hand had rotated backward to zero and also to a point beyond an additional amount, which could readily be determined by experience or by obtaining data from the battery-makers as to the proper percentage to allow in recharging for internal loss in the

battery during discharge. If the hand has been carried past zero in recharging, it is desirable to have it reset at zero preliminary to starting out with the batteries fully charged. To provide for this the instrument is equipped with a resetting device located just below the recording train. The device is

FIG. 2.—SERVICE TYPE METER, WITH CASE REMOVED.

similar to the pendant set of a watch, and is fitted with a detachable key. By pushing in the key and turning slightly the hand can be brought to zero from any position without disturbing the mechanism of the meter or the train. For vehicle work the instrument possesses many advantages. An automatic cut-off attachment is fitted to the meter and any amount of recharge can be determined, the pointer set for this, and upon the completion of its revolution, or partial revolution, when the battery is in a fully charged condition, the circuit will be automatically opened. This is effected by placing an insulated contact point at the zero on the dial and taking the auxiliary circuit out through a pair of extra binding posts on the meter, operating a relay-battery circuit to open a switch in the charging circuit.

Indirect Lighting from Fixtures for a Large Auditorium.

To accommodate banquets, balls, concerts and the like, the South Shore Country Club, of Chicago, is erecting a large auditorium, 120 ft. x 90 ft. Marshall & Fox are the architects, and, early in the making of the plans, they decided to use some system of indirect lighting for this auditorium, considering arc lamps and the cove system, but finally deciding to use the "I-Comfort" fixtures. These fixtures consist of inverted silver-plated glass reflectors, containing in this case 130-watt tungsten lamps, the light from which is reflected from the ceiling, while the lamps themselves are not visible, so that there is general illumination without glare or eye strain. The central portion of the South Shore auditorium will be lighted by three large, handsome chandeliers, each containing 23 of the inverted fixture units. In addition there will be 28 separate fixtures of this type suspended in the promenade of the auditorium surrounding the central portion. The hall is treated in ivory and red, with a paneled ceiling, and it is anticipated that an excellent lighting effect will be obtained. The consumption of electrical energy will be the same as that planned for direct illumination, while the cost of the fixtures will be $850, as compared with $1,500 for the direct-lighting planned. It is said that this auditorium will be the first large hall or assembly room of this character west of Washington to be lighted in this manner.

New Type of Outlet Box.

There are many kinds of outlet boxes on the market, and the tendency now is to simplify them so that jobbers and contractors will not be obliged to carry a large variety of stock

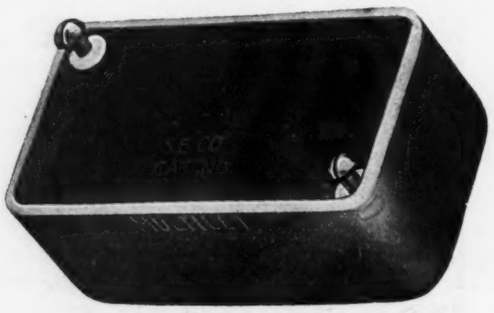


FIG. 1.—KNOCKOUT BOX.

to meet the demands. To this end the Sprague Electric Company has placed on the market a box to which the name "Multilet" has been given, because it signifies the aim of the manu-

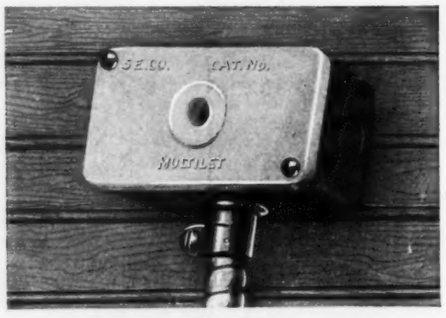


FIG. 2.—WIRE PORCELAIN COVER.

facturer—one box for many purposes. The box, which is shown in Fig. 1, is of the knockout type and made of stamped steel; it has one outlet in each end, one in the bottom, one in one

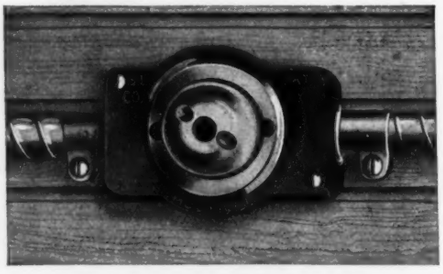


FIG. 3.—FLOOR RECEPTACLE COVER.

side and two in the other. The box is made in two sizes and has a set of covers for each size, which enable any necessary combination to be made for use with rigid conduit, Greenfield

FIG. 4.—PENDANT COVER.

flexible steel conduit, or Greenfield flexible steel-armored conductors. This makes it unnecessary for the dealer to handle

a variety of boxes and also enables the wireman to complete his work without expensive delays caused by inability to find just what he needs. It is not necessary to wait for special fittings for special work, and the new box insures uniform and safe installation. The box accommodates standard fittings,

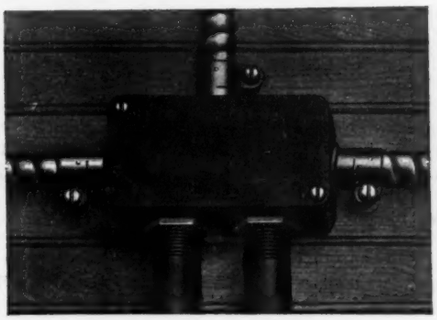
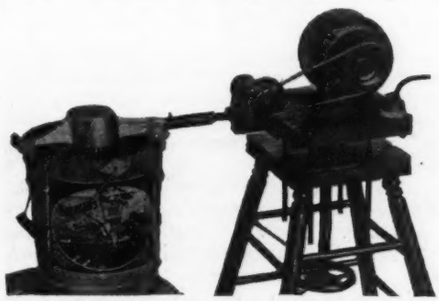


FIG. 5.—CLOSED COVER, WITH CONDUIT KNOCKOUT.

such as receptacles, rosettes, etc., in addition to snap switches for both surface and concealed work. Boxes and covers, with the exception of porcelain covers, are made in galvanized and in black enameled finish. Figs. 2, 3, 4 and 5 show "Multilet" covers.

Portable Motor for Family Use.

The accompanying illustration shows a portable motor brought out by the Steiner Manufacturing Company, of St. Louis, Mo., and intended for family use. The outfit comprises a portable stand mounted on ball-bearing castors fitted with a 1/6-hp motor of either the direct-current or alternating-current type for driving sewing-machines, washing-machines, wringers, ice-cream freezers, meat-choppers, coffee-mills, buffers, grinders and other household appliances, the idea being to employ the same motor for a variety of purposes. The height of the motor from the floor is adjustable within limits by means of a hand-wheel, as shown in the engraving, and the machine is



PORTABLE MOTOR FOR FAMILY USE.

entirely enclosed so as to preclude the possibility of danger to children or others who might not be over-careful of their movements in the vicinity of the apparatus. In addition to the shaft, the motor is equipped with a cone pulley in steps of 2 in., 3 in. and 4 in., and is belted to a special gear of pulleys of the same size so that three speeds are obtainable with a constant-speed motor. The gear, which is made of bronze metal and steel, is also enclosed. The company markets a line of household utensils especially adapted for use in connection with the motor.

Meeting of the Technical Publicity Association.

The annual meeting of the Technical Publicity Association, which was held April 8, marked the fourth year of its existence. The reports of the secretary and treasurer indicated that the association is in a healthful condition financially, and that the membership is constantly increasing. The association now numbers among its members the advertising men connected with the largest machinery manufacturing and allied industries of the country.

The report of the circulation committee showed that the association has on file reports from several hundred of the leading technical publications in the United States and Canada, which have been of considerable value to the members and are being constantly referred to. The reports of the committee on publicity, receptions and entertainments showed good work being accomplished in these lines. The election of officers for the ensuing year resulted in but few changes. The following officers were elected:

President, Mr. C. S. Redfield; first vice-president, Mr. C. N. Manfred; second vice-president, Mr. O. C. Harn; secretary, Mr. H. H. Kress; treasurer, Mr. H. M. Davis. Additional members of executive committee and directors: Messrs. Rodman Gilder and C. W. Beaver.

The subject of the meeting was "Trade Paper Copy," and a number of advertisements of the various members clipped from the trade papers were projected on a screen by means of a stereopticon, and were then criticized by the various speakers. Mr. Walter B. Snow, publicity engineer, Boston, on "The Text Matter"; Mr. Fred L. Dion, of the Willetts Press, New York, on "Typography," and Mr. George Leland Hunter, New York, on "Balance and Proportion in Display." Prizes of gold-mounted fountain pens were presented for the advertisements considered best as to text, typography and illustrations. Among others who contributed to the interesting topic of the evening were Mr. George French, editor of *Profitable Advertising*, and Mr. St. Elmo Lewis, advertising manager of the Burroughs Adding Machine Company, Detroit, Mich.

New Nernst Chandelier.

The Nernst Lamp Company has added to the designs of Westinghouse Nernst chandeliers the box-type renaissance chandelier shown in the accompanying illustration. The design

NEW NERNST CHANDELIER.

is massive and substantial, and its middle portion is larger than the round-type renaissance design previously brought out. This gives the fixture a more compact appearance and adds to the artistic effect when the lamps are not burning. It is made for 66, 88, 110 and 132-watt lamps.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Hope for the future rather than present improvement is the best that can be said of trade conditions during the past week. There has been a little more business done in wholesale lines for next fall and winter delivery, but most of the business for immediate shipment is of the filling-in character, and is very spotted. Retail trade has been retarded to some extent on account of the cold and wet weather in many sections of the country. This also has done something to interfere with the prospects of the coming crops. The break in the unusually high prices of wheat and of cotton has stimulated some buying, but even this is unimportant. Taken as a whole, the tariff uncertainty, the backward weather and crop conditions are a bar to the activity of trade and also of industry. The underlying feeling, however, is that these restrictions will be removed very speedily, and that we may look for improvement during the summer, and heavy business in the fall. In industrial lines, pig iron has been more active, but there has been some falling off in orders for finished materials. It is said that electrical apparatus and agricultural implements are showing some improvement, and that cast iron pipe and heating apparatus have also developed some activity. Building is fairly active all over the country, and the number of permits that are being issued indicate that there will be a large business in this line during the summer. Collections show very little change, but are classed as only fair. Money, however, is easy, and financial troubles are not important. Businesss failures, for the week ended April 22, were 247, against 201 the previous week; 254 for the same week of last year; 157 in 1907; 177 in 1906, and 193 in 1905.

THE COPPER MARKET.

There has been little vitality to the copper market during the past week, and few sales have been made either for export or for domestic consumption. Prices have been fairly well maintained in view of the small demand, and there seems to be little disposition on the part of the producers to make concessions. American consumers have confined their purchases to a few small lots for early delivery, but it is reported that there have been some inquiries for fairly large amounts for May and June delivery. So far as reported, no sales of this character have been made. It is stated that some electrolytic, for spot delivery, has been recently sold as low as 12½ cents. The majority of sales, however, have been made between 12⅝ and 12¾, and this is especially true when delivery is to be made within 30 days. Production continues at about the same ratio as has been recorded during the past few months, and the domestic consumption will be considerably smaller than that reported in March. On the other hand, the actual exports of copper for April will probably be larger than for any month within the past year. These exports, of course, reflect sales that were made in March and are not immediate takings. There will be an addition to the surplus supply, which will probably be considerably larger than that reported by the Copper Producers' Association for March. Exports so far for the month, up to and including April 26, have been 23,523 tons. Quotations on the metal exchange April 26 were:

Lake	12⅞ @ 13
Electrolytic	12½ @ 12⅝
Casting	12⅜ @ 12½

The London market April 26 was as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	57 12 6	57 12 6
Standard copper, future	58 7 6	58 7 6
Market	Firm.	Quiet.
Sales of spot		700 tons
Sales of futures		1,500 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

TARIFF ON ARC-LIGHT CARBONS.—In speaking of the tariff on carbon situation and the controversy to which it has given rise, a representative of one of the largest American factories objected to some of the statements repeated in these columns bearing on the subject. "We have been producing flaming-arc carbons for considerably more than a year," he said, "and are selling them in quantities to dealers and the largest consumers in the United States right along. I might say further that if the buyers of these carbons will compare the prices that are made to-day with the prices they paid for the same kind of carbons before we began to manufacture them I am sure they will agree that it is the competition of American manufacturers that regulates the prices of the imported carbons more than the tariff. This is only a repetition of the experience of carbon users in this country which occurred at the time enclosed arc carbons were first produced here. A comparison of the prices made by the importers before these carbons were made in America with the present rate on the same grade of carbons will further verify my contention that the consumer would be paying a great deal more for carbons to-day were it not for the competition of the American manufacturers. A casual investigation of the market will prove that the importers' prices are kept about on a level with those of the American manufacturers. If they are so anxious to reduce this basis, it seems to me that they have plenty of leeway to do so without waiting for a reduction of the tariff. In their testimony before the Ways and Means Committee they stated that ½ x 12-in. solid enclosed arc carbons cost them in the neighborhood of $14 per thousand, freight and duty paid to New York, including the cost of cutting double and triple lengths to standard lengths. Consumers are familiar with the fact that the importers sell these carbons at an average of about $25 per thousand, so I believe they will agree with the statement I have just made that the tariff does not necessarily regulate the prices of the imported, as it is quite clear that the importers could at any time greatly reduce their prices and still have a handsome profit if they cared to do so. The rate of 70 cents per hundred feet proposed by the Senate Finance Committee would not permit any advance in the selling prices of carbons for enclosed lamps, flaming-arc lamps and moving picture lamps, or any other high-grade carbons, despite the statements by the importers to the contrary; and even if the duty were placed at a still higher rate which might permit an increase, no such action is contemplated by my company, as it would be contrary to its policy of reducing prices when the cost of manufacture permits, this being evidenced by the reduction recently made by it in prices on dry batteries. Comparatively speaking, the rate of duty proposed by the Senate bill is no higher than that in force in Germany and France, the countries from which the importers get their supply of carbons; and without entering into a discussion of the principles of a protective tariff, I am confident the American consumer will enjoy lower prices on carbons if they have the benefit of American competition than they would if the importers had the field alone."

EXHIBIT FOR SEATTLE EXPOSITION.—The General Electric Company shipped last week three carloads of material to Seattle, Wash., as an exhibit in the Alaska-Yukon-Pacific Exposition. Almost every class of apparatus is included in the display, from heavy mining machinery and electric locomotives to the latest household appliances. The General Electric Company has furnished the equipment for the exposition buildings, which does not include generating machinery as the energy for the exposition is purchased from the local power company.

THE McCORD ENGINEERING COMPANY has been organized in Atlanta, Ga., carrying on a general contracting business in electrical, mechanical and civil engineering. The company has equipped a complete electrical testing laboratory and repair shop and will have an efficient force of workmen to send out on all classes of electrical repairs. The company is composed of Messrs. J. L. McCord, W. P. McCord and C. M. McCord, with offices at 101 South Forsyth Street and shops at 2 Nelson Street.

WESTINGHOUSE BUSINESS CONTINUES TO IMPROVE.—The improvement in the business of the Westinghouse Machine Company's shops at East Pittsburgh continues to be encouraging. Since April 1 quite a number of orders for steam turbines, steam engines and gas engines have been booked and the record for the first two weeks of the month shows a considerable increase over the same period of March. Among the contracts particularly worth mentioning which the company has lately received is an order from the City Electric Company, of San Francisco, for a 15,000-hp steam turbine. This will be the most powerful steam turbine installed west of the Mississippi, its power capacity being about equal to 10 of the largest-size express railway locomotives. This company has already installed three Westinghouse steam turbines of a smaller size. The East Pittsburgh shops are also turning out at present on order from the city of Detroit a 3000-hp steam turbine, and another of the same size is going to the Nichols Copper Company, of Laurel Hill, L. I., while the Saginaw & Flint Railroad Company, of Michigan, has contracted for an 1150-hp turbine, and the Alaska Treadwell Gold Mining Company, of San Francisco, has ordered two 1000-hp machines of the same type.

THE SHELTON ELECTRIC COMPANY, of Chicago, manufacturer of electric vibrators and hair-driers, has increased its capital stock to $100,000, and will remove its headquarters to New York on May 1. Attractive quarters have been secured at 105 West Forty-second Street, and here much more space will be available than in the Chicago office, which will be continued at 35 Randolph Street. The company expects to make a decided increase in its business by this change. It will soon bring out a new electric hair-drier, which is said to embody many improvements. The officers of the Shelton Electric Company are: President, W. G. Shelton; vice-president, L. C. Shelton; secretary, A. J. Crowley.

TO BUILD HIGH-SPEED ROAD IN TEXAS.—The Stone & Webster Engineering Corporation has contracted for the design, construction and equipment of an interurban electric railway between the cities of Galveston and Houston, Tex. The distance is about 50 miles and the road will be designed for high-speed operation. The engineering work includes the final surveys, determination of right-of-way, design of bridge structures, the working out of the most economical car schedules and the selection of types of rolling stock best adapted to the conditions. The contract includes the design and construction of the power station, transmission lines and substations.

NEW MEXICO HYDRO-ELECTRIC DEVELOPMENT.—Powell Stackhouse, Jr., and associates, who operate large coal mines at Carthage, New Mexico, are preparing to install a large central electric power plant there. Transmission lines will be built from this plant to El Paso, Silver City, Deming and Albuquerque. The power that will be generated at this plant, in addition to being used by various kinds of industrial enterprises, will be available for the operation of pumping plants for irrigation works in the valleys of the several different streams which the transmission lines will reach.

COPPER IN CENTRAL AFRICA.—The holdings of the Tanganyika Concessions company, a British corporation, in British Central Africa are said to be the most extensive and richest copper properties ever discovered. W. G. Perkins, formerly superintendent of the Steptoe Smelting & Mining Company, together with Alan McCormack and P. K. Horner, of the same property, have been engaged to develop the proposition. They will leave in a few weeks for Africa. It is claimed that these new copper mines will be able to produce the metal cheaper than any others in the world.

NEW YORK TELEPHONE COMPANY EXPANDING.—During the past week the New York Telephone Company has purchased the property at Nos. 18 to 30 on Lispenard Street, and from No. 18 to No. 26, inclusive, on Walker Street. The entire plot contains about 21,000 sq. ft., and it is understood that the telephone company intends to erect thereon a high office building in which will be grouped several of the company's exchanges. The exact plans for the building have not yet been given out.

OIL BURNING LOCOMOTIVES THROUGH THE FORESTS.—Both the New York Central and the Delaware & Hudson railroads have informed the Public Service Commission of the Second District of New York that they will at once equip their locomotives running through the forest preserves of the State for oil burning. This is in acceptance of an order, recently issued, intended to prevent forest fires.

ALLIS-CHALMERS COMPANY.—One of the most important sales recently made by the Allis-Chalmers Company is that of three 5000-kw steam turbines to the Interstate Railways Company for installation in the power house of the United Traction Company at Reading, Pa.

Financial Intelligence.

THE WEEK IN WALL STREET.

During the past week the stock market in Wall Street, while it has been reasonably active, has been rather uncertain as to its tendency. Generally speaking, there is an optimistic feeling and prices are inclined to be somewhat higher. On the other hand, there are a great many opinions expressed that the present prices of stocks have fully discounted the developments that may be expected within the next six months in industrial and commercial business. This difference of opinion, of course, occasions some trading. It is undeniable that within the past two or three weeks there has been quite a lot of profit taking, both by the small stockholders and by large interests; if it had not been for this the upward movement of the market would have been unchecked. Whether the principal traders have reinvested at lower levels or not it would be hard to determine; it is sufficient to say that there seems to be fully as much interest displayed on the buying side of the market as on the selling side. Such a condition as this, if the tariff matter was settled, and other disturbing influences were removed, would make a very active market, probably without any great amount of price change. The condition of the money market is such that trading and speculation are very distinctly encouraged. Money is easy, and bond issues are rapidly absorbed. This was demonstrated last week when the $18,000,000 issue of the St. Louis & San Francisco Railroad was taken up without creating any flurry in the Street, and when the $5,000,000 new issue of the Corn Products Refining Company found immediate acceptance. The ease and facility with which corporate enterprises are now able to secure money is almost unprecedented in the history of Wall Street. The proposed financing of the Chicago, Burlington & Quincy, which will involve the placing of $65,000,000 of new refunding bonds, is generally accepted as an undertaking that will meet with no serious obstacles. The modification of the Public Service Commission's terms for the Erie bond issue has done much to strengthen the securities of that road. These modifications are practically all that was asked by the management of the company. Call money on April 26 was 1½@2 per cent, while 90-day loans were made at 2¾@3 per cent. The quotations in the table are those of the close, April 26.

NEW YORK.

	Apr. 19.	Apr. 26.	Shares Sold.		Apr. 19.	Apr. 26.	Shares Sold.
All.-Ch.	16	15½	13,300	Int.-Met., pfd.	44½	44¾	45,225
All.-Ch., pfd.	49⅞	49⅛	31,975	Mackay Cos.	76*	78½*	7,900
Amal. Cop.	76¼	76⅜	100,190	Mackay Cos., pfd.	72½*	73½*	1,500
Am. D. T.	29*	29*	———	Manhattan Elev.	145¼*	144¾*	980
Am. Loc.	54½	54½	17,280	Met. St. Ry.	22½	26	1,890
Am. Loc., pfd.	114	114	320	N.Y. & N.J.Tel.	123	124*	400
Am. Tel. & Cbl.	76*	76*	———	Steel, com.	52¼	53	428,962
Am. T. & T.	137¼	139¾	128,725	Steel, pfd.	114½	114¾	13,870
B. R. T.	76⅞	77½	57,085	W. U. T.	70	68½	3,000
Gen. Elec.	159½	158¼	3,900	West'h., com.	83	81½*	4,900
Int.-Met., com.	15¼	15⅜	23,720	West'h., pfd.	120	119*	600

PHILADELPHIA.

	Apr. 19.	Apr. 26.	Shares Sold.		Apr. 19.	Apr. 26.	Shares Sold.
Am. Rys.	46*	45½	———	Phila. Elec.	12	12	———
Elec. Co. of A.	12½	12¼*	———	Phila. R. T.	35½	35⅛	———
Elec. Stor. B'ty.	45⅞	45¾*	———	Phila. Traction.	93	93*	———
E. S. B'ty, pfd.	49*	49*	———	Union Traction.	57⅛	57¼	———

CHICAGO.

	Apr. 19.	Apr. 26.	Shares Sold.		Apr. 19.	Apr. 26.	Shares Sold.
Chi. City Ry.	180*	180*	———	Chi. Tel. Co.	133½	133*	———
Chi. Rys., Ser.1.	110*	110*	———	Met. El., com.	17¾*	19	———
Chi. Rys., Ser.2.	40	39	———	Nat'nal Carbon.	82*	84	———
Com. Edison.	114	114	———	Nat. Carb., pfd.	120*	120*	———
Chi. Subways.	26	25½	———				

BOSTON.

	Apr. 19.	Apr. 26.	Shares Sold.		Apr. 19.	Apr. 26.	Shares Sold.
Am. Tel. & Tel.	137⅛	139	———	Mex. Tel.	2¾	2¾*	———
Cum. Tel.	130*	131	———	Mex. Tel., pfd.	6*	6*	———
Edison El. Ill.	259	258	———	N. E. Tel.	133¾	132	———
Gen. Elec.	159	158	———	W. Tel. & Tel.	9	9	———
Mass. Elec. Ry.	14¼*	14¼*	———	W. T. & T., pfd	78*	83	———
Mass. E. R., pfd	71½	72	———				

*Last price quoted.
Shares sold are for week April 19 to April 24.

DIVIDENDS.

The J. G. Brill Company, preferred, quarterly, 1¾ per cent, payable May 1.

Connecticut Railway & Lighting Company, preferred and common, quarterly, 1 per cent each, payable May 15.

Helena (Mont.) Light & Railway Company, preferred, quarterly, 1¼ per cent, payable May 1.

Montreal Light, Heat & Power Company, quarterly, 1½ per cent, payable May 15.

Municipal Gas Company, Albany, N. Y., quarterly, 2½ per cent, payable May 1.

National Carbon Company, preferred, quarterly, 1¾ per cent, payable May 15.

Ohio Traction Company, Cincinnati, preferred, quarterly, 1¼ per cent, payable May 1.

West Pennsylvania Railways Company, Pittsburgh, preferred, quarterly, 1¼ per cent, payable May 1.

HUDSON & MANHATTAN STOCKHOLDERS.—The publication of a list of the 20 largest stockholders of the Hudson & Manhattan Railroad Company, according to the books on June 30, 1908, has created some surprise. The particular feature that has caused the most comment in financial circles, is the fact that J. P. Morgan & Company at that time owned 6666 shares of the preferred stock, and interests affiliated with that firm many times that number of shares. The largest stockholder was, of course, the Hudson Companies, and the next largest Simpson, Thatcher & Bartlett. Mr. W. G. McAdoo, president of the company, is credited with having 32 shares. The publication of the Morgan interest in the company has given rise to gossip as to the possibility of an ultimate connection between the McAdoo system and the Brooklyn Rapid Transit. Such a connection, however, is as yet a mere conjecture.

THIRD AVENUE RAILROAD EARNINGS.—According to a report made by Receiver F. W. Whitridge, the earnings of the Third Avenue Railroad Company have increased $500,000 in the year which ended March 31. Mr. Whitridge places the increased number of fares received in that time at approximately 10,000,000. He attributes a large proportion of this gain to the use of the pay-as-you-enter fare boxes. He says that the company has received a very much larger percentage of the fares than it did formerly, not because of the dishonesty of some employees so much as to the fact that every person now pays. He also attributes the increase in patronage to the better service which the company is giving on account of the improvements in equipment which have been made. He says that the first three days after the transfer system was stopped the road lost 60,000 passengers per day, but that it has gradually regained them.

UNITED STATES LIGHT & HEATING COMPANY.—Formal announcement of the consolidation of car-heating properties, which was noted in detail in the issue of April 1, has been made by the Edwin Hawley syndicate, which promoted the merger. No additional facts concerning the organization were made in the official announcement. The new company, the United States Light & Heating Company, has been organized under the laws of Maine and will take over the Bliss Electric Car Lighting Company, which is owned by the Cutler-Hammer Company, the National Battery Company, of Buffalo, and the United States Light & Heating Company, of New Jersey. W. H. Silverthorn, president of the Railway Steel Spring Company, is president of the new organization and the board of directors includes the names of a number of men well known in railroad and financial circles. The capital of the new company will be $17,500,000.

GENERAL ELECTRIC OFFICIAL REPORT.—The annual report of the General Electric Company for the fiscal year which ended Jan. 31, 1909, has just been issued. A digest of the report will be found on page 1008 of this issue. It shows that the total sales billed for the year were $44,540,676. The company reports that at the present time its sales are at a rate of about $8,000,000 per year better than they were two months ago. It it stated that at present the rate of business is about $52,000,000 per annum. The improvement seems to be general in all departments. Small equipment has shown better development than have the orders for street railway apparatus and for large installations. The company is still carrying its enormous cash balance, its annual report showing that on Jan. 31 there was more than $22,233,671 in cash on hand.

MASSACHUSETTS LIGHTING CONSOLIDATION.—A special meeting of the stockholders of the Boston Edison Illuminating Company will be held to authorize the purchase of the property of the following corporations used in the business of generating and furnishing electricity for light and power: Chelsea Gas Light Company, Boston Consolidated Gas Company, Newton & Watertown Gas Light Company, Waltham Gas Light Company and the Lexington Gas & Electric Company. If these purchases are authorized by the stockholders, steps will be taken at once to fix terms and conditions under which the properties will be operated.

WEST VIRGINIA TELEPHONE LINES SOLD.—The property and lines of the Consolidated Telephone Company, of Fairmont, W. Va., consisting of all of the independent systems in Marion, Harrison, Taylor, Upshur, Randolph, Tucker, Preston and a part of Monongalia counties have been sold to Z. F. Robertson. Mr. Robertson is said to represent New York and Chicago capitalists who will reorganize these properties into one company, and form a link in the chain of independent telephone companies which are now being developed in the Central West.

VINCENNES TRACTION COMPANY SOLD.—The Vincennes Traction & Light Company has sold its entire property, including the street railway system, to capitalists from Louisville, Ky., who will at once reorganize the company and improve the system. S. A. Culbertson is president of the new company; S. S. Bush, vice-president, and Attilla Cox, secretary and treasurer. The traction lines will be extended, new car barns constructed and probably a new power installation purchased. The plans of the new company have not yet been given out.

SAO PAULO TRAMWAY, LIGHT & POWER COMPANY.—Negotiations are pending for the purchase of the Gas Company of Sao Paulo, Brazil, by the Sao Paulo Tramway, Light & Power Company. If negotiations are successfully carried through, it is intended to arrange the capital of the gas company by retiring the present common stock, and to issue new common and preferred stock of the purchasing company therefor. This would provide a return of about 11 per cent on the present stock.

SEATTLE ELECTRIC COMPANY BONDS.—Lee, Higginson & Company have sold $1,600,000 Seattle Electric Company first mortgage 20-year, 5 per cent bonds. These bonds are part of an authorized issue of $5,000,000, and were offered at 98½ and interest. The bonds are a direct obligation of the Seattle Electric Company, and are secured by a first mortgage on the interurban railway between Seattle and Everett. The bonds were almost immediately taken by the public after the offer was made.

THE NORTH AMERICAN COMPANY.—It is said that negotiations are under way for the sale of the Laclede Gas Light Company, of St. Louis, owned by the North American Company, to the American Light & Traction Company. This matter will be considered at the next meeting of the directors, which will probably be held this week.

CAMDEN & TRENTON RAILWAY COMPANY REORGANIZATION.—A committee representing the bondholders of the Camden & Trenton Railway Company has signed an agreement under which that company will be reorganized. The new company will be known as the Riverside Traction Company, and will have an authorized bond issue of $1,500,000; preferred stock of $400,000, and an authorized common stock of $1,100,000.

CONNECTICUT RIVER WATER POWER.—A project has recently been formulated at Littleton, N. H., for the construction of three large dams on the Connecticut River, involving an investment of about $6,000,000, which, it is stated, will be furnished by Chicago capitalists. It is believed that this project will develop more than 5,000 hp between the towns of Dalton, Mass., and Monroe, N. H.

SAN DIEGO LIGHT BONDS SOLD.—N. W. Harris & Company, of New York, have purchased from the San Diego (Cal.) Consolidated Gas & Electric Company $1,600,000 first mortgage 5 per cent bonds. This company operates the entire gas, electric light, heat and power business of the city of San Diego, and the bonds will probably be offered to the public at an early date.

INDEPENDENT TELEPHONE CONTROL CHANGES.—Portland, Ore., and Seattle capitalists have secured control of the stock of several independent telephone companies in the Pacific Northwest from the National Securities Company, of Los Angeles. The deal means the transfer of stock in the independent companies valued at about $750,000. A syndicate composed of Sam Hill, Hervey Lindley, E. A. Stuart, W. G. Collins and M. A. Arnold, of Seattle, and William M. Ladd, P. L. Willis, W. F. Burrell, F. H. Page and I. N. Fleischner, of Portland, has purchased the entire stock holdings of the National Securities Company in the three independent telephone companies in Oregon and Washington. This constitutes between 40 and 50 per cent of stock of the Home Telephone Company, of Portland, the Home Telephone Company, of Puget Sound, and the Northwestern Long Distance Telephone Company, of Portland. Over 50 per cent of the stock of the long-distance company has been taken over. Arrangements have been made for the expenditure of $200,000 on improvements to the Portland plant, and engineers are now drawing up the plans. It is announced that this will be followed by a further outlay of $500,000 within the coming year. A large amount is also to be expended in Tacoma on immediate betterments to the Puget Sound company's plant.

ALASKAN COPPER MINES SOLD.—One of the largest copper deals made in recent years has been effected by the purchase of control of the Alaska Copper & Coal Company, which is commonly known as the Bonanza Mines, by the Guggenheim interests and J. P. Morgan & Company. These purchasers have formed what is known as the Alaska Syndicate and have taken over the holdings in the mines which were controlled by Norman Shultz and his associates. It is said that the price paid was between $2,000,000 and $3,000,000 less than was offered for the same property several years ago. These mines are said by experts to be the richest copper properties that have yet been opened. It is claimed that the new syndicate will be able to produce copper at less than 6 cents per pound. The Copper River Railroad, which is being built by the Morgan and Guggenheim syndicate, will run to the mines in about a year. This railroad is necessary for the development of the properties. The ore will be shipped by the company's own boats, connecting with the railroad at Cordova. It will probably be smelted at the Tacoma smelters of the American Smelting & Refining Company. It is also stated that a copper-wire plant may be built at Tacoma.

ELEVATED RAILWAY EXTENSION IN CHICAGO SUBURBS.—It is said that the Chicago & Oak Park Elevated Railroad will be extended from Harlem Avenue, the western limit of Oak Park, to Elmhurst, Ill., as a result of the recent municipal election in River Forest, in which the question was an issue. The new trustees are believed to favor the extension, and the president of the elevated railroad company says that the ordinance will be introduced immediately and passed. The extension will be four miles long. It will be another link in the proposed Chicago & Elgin Electric Railroad, by which it is planned to reach the Fox River Valley from Chicago.

LAKE SUPERIOR CORPORATION.—The Lake Superior Corporation has closed the sale of about $1,000,000 of its preferred first mortgage collateral bonds, and $2,000,000 of the Lake Superior Iron & Steel Company's 6 per cent notes. The price paid for the bonds, it is said, was about 80. These sales will give the Lake Superior Corporation $2,500,000 in cash as a working basis for doing business, and for payment of bank loans.

WILLIAMS, McCONNELL & COLEMAN is the name of a firm just formed to take over the business of Eglinton, Hammond & Andrews, brokers and dealers in investment securities. The firm will devote especial attention to the securities of electrical companies and public service corporations. The members of the firm are George Williams, H. F. McConnell and L. G. Coleman. The office is at 60 Wall Street.

NEW JERSEY PUBLIC SERVICE CORPORATION.—Notice has been given by the Public Service Corporation, of New Jersey that, pursuant to the provisions of the indenture securing its $6,250,000 convertible gold bonds which mature the first of next November, the holders may between April 15 and May 1 present the same for conversion into an equal amount of the stock of the company at par.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Birmingham (Ala.) Railway, Light & Power Company:					
March, 1909	$181,818	$114,203	$67,614	$44,787	$22,826
March, 1908	177,003	112,686	64,317	42,863	21,453
Calumet & South Chicago Railway Company:					
Year ended Jan. 31, 1909	839,296	578,910	260,386	.....	.....
Year ended Dec. 31, 1908	875,016	606,512	268,504	.....	.....
Cape Breton Electric Company, Limited, Sidney, C. B.:					
February, 1909	15,891	11,559	4,332	3,996	335
February, 1908	18,024	11,827	6,196	4,038	2,158
Chicago Railways Company:					
Year ended Jan. 31, 1909	11,037,071	7,725,950	3,311,121	.....	.....
Year ended Jan. 31, 1908	10,560,571	7,392,400	3,168,172	.....	.....
Edison Electric Illuminating Company, Brockton, Mass.:					
February, 1909	23,416	12,633	10,782	2,761	8,021
February, 1908	18,604	10,819	7,784	1,839	5,945
Edison Electric Illuminating Company, Brooklyn:					
March, 1909	289,298	143,674	145,623	82,619	63,003
March, 1908	272,157	133,646	138,510	80,260	58,249
Guanajuato Power & Electric Company:					
Year 1908	463,974	110,761	353,214	114,428	238,786
Year 1907	394,189	88,758	305,431	101,848	203,582
Houghton County (Mich.) Electric Light Company:					
February, 1909	24,303	10,643	12,826	3,382	9,443
February, 1908	21,909	9,800	12,109	3,180	8,929
Knoxville (Tenn.) Railway & Light Company:					
March, 1909	47,130	24,158	22,972	11,483	11,488
March, 1908	46,521	23,251	23,270	11,623	11,647
Little Rock (Ark.) Railway & Electric Company:					
March, 1909	56,586	27,548	29,040	11,023	18,117
March, 1908	56,552	28,226	28,326	8,190	20,136
Lowell (Mass.) Electric Light Corporation:					
February, 1909	29,553	16,495	13,058	3,641	9,416
February, 1908	28,906	16,014	12,891	4,333	8,557
Memphis Street Railway Company:					
March, 1909	133,151	84,512	48,639	35,489	13,150
March, 1908	128,857	83,705	45,152	34,836	10,316
Minneapolis General Electric Company:					
February, 1909	96,189	36,046	60,142	30,528	29,614
February, 1908	84,583	35,922	48,661	31,011	17,649
Montreal Street Railway Company:					
March, 1909	298,727	206,832	91,895	35,994	55,994
March, 1908	288,674	202,389	86,284	38,118	48,165
New Orleans Railway & Light Company:					
Year 1908	5,968,498	3,364,984	2,137,283	1,566,789	570,494
Year 1907	5,999,730	3,287,712	2,223,797	1,477,784	746,012
Northern Ohio Traction & Light Company:					
March, 1909	150,684	86,720	63,964	43,803	20,161
March, 1908	129,659	81,273	48,386	43,953	4,433
Oneida Railway Company:					
Quarter ended Dec. 31, 1908	83,930	56,911	27,018	.....	.....
Quarter ended Dec. 31, 1907	68,443	46,823	21,619	.....	.....
Puget Sound Electric Railway & Subsidiary Companies:					
February, 1909	128,441	94,088	34,353	40,405	9,960
February, 1908	117,501	79,787	37,713	37,713	3,436
Toledo Railways & Light Company:					
March, 1909	213,766	118,714	96,122	63,457	32,665
March, 1908	201,128	114,879	87,304	68,898	18,408
United States Telephone Company, Fostoria, Ohio:					
Year 1908	444,849	212,877	260,655	107,800	152,855
Year 1907	435,013	193,212	276,766	107,800	168,966

GENERAL NEWS

Construction News.

RECTOR, ARK.—The Rector Co-operative Telephone Company has increased its capital stock from $5,000 to $15,000.

HOLLISTER, CAL.—Bids will be received by the Board of Supervisors until May 17 for the franchise for a transmission line, for which application was made by William Palmtag.

RED BLUFF, CAL.—The Sierra Electric Power Company has secured a franchise from the Board of Supervisors to erect a transmission line from its plant of Battle Creek through the county. The company bid in the franchise which was sold April 6 for $60. Frank C. Wilson is secretary.

REDDING, CAL.—A large alfalfa meal plant is to be installed at Alberta, about nine miles south of Red Bluff. The plant will be operated by electricity, which will be furnished by the Northern California Power Company.

STOCKTON, CAL.—Preparations are being made by the San Joaquin Valley Electric Railway Company for the construction of its proposed electric railway to connect Stockton, Modesto, Riverbank and intervening towns. The railway will be 44 miles long. Arrangements have not yet been made for securing electricity for operating the cars. G. O. Broadhurst, of Stockton, is chief engineer; Morris L. Brackett, of Stockton, and Metropolitan Life Building, New York, N. Y., vice president.

TEHAMA, CAL.—Application has been made to the Board of Town Trustees by J. J. Worthington for a franchise to construct and operate an electric railway on D, E and Second Streets in Tehama.

VALLEJO, CAL.—Preparations are being made by the San Francisco, Vallejo & Napa Valley Electric Railroad Company to extend its railway from St. Helena to Calistoga, for which rights of way are now being secured. It is proposed to eventually extend the road into Lake County.

VISALIA, CAL.—The Visalia Electric Railroad Company is said to be willing to construct a railway to Woodlake district, connecting with the Naranjo district, provided the right of way can be secured without cost to the company. The cost of the railway is estimated at $200,000. J. H. Crossett is superintendent of the company.

RIFLE, COL.—Plans are being prepared by the Rifle Light, Heat & Power Company for the construction of a power plant to cost from $45,000 to $50,000, bids for construction of which will be received about June 1. O'Brian & Tomlinson, Nassau Building, Denver, Col., are the engineers; W. J. Le Rossignol is secretary.

HARTFORD, CONN.—The Senate has passed the bills authorizing the Standard Electric Company to issue bonds; incorporating the Crescent Beach Power & Water Company, the North Brandford Light, Water & Power Company, and amending the charter of the Lebanon Street Railway Company.

AMERICUS, GA.—Plans are being prepared for the construction of a municipal electric light plant in connection with the water-works system, the cost of which is estimated at $20,000.

AUGUSTA, GA.—Investigations are being made by Lamar Lyndon, of Dunbar & Lyndon, consulting engineers, 2 Rector Street, New York, N. Y., with a view of making extensive water power developments on the Saluda River, Lexington County, S. C. It is stated that James U. Jackson and other Northern capitalists are interested in the project.

COLUMBUS, GA.—The Perkins Hosiery Mills has awarded the contract for the erection of a two-story building to John H. Lowe, of Atlanta, Ga. The equipment of the building will include 8000 spindles, 24 cards and accompanying textile equipment, to be operated by electrical power. An additional engine of from 350 to 400 hp will be installed.

COLUMBUS, GA.—The city of Columbus, the Board of Trade and the Consumers' Association have filed a complaint with the State Railroad Commission against the Columbus Railroad Company and the Gas Light Company, of this city, alleging excessive charges for electric and gas service. The prices for electrical service are as follows: Arc lamps, $60 per lamp per year; incandescent lamps, $24 each, and 15 cents per kw-hour to consumers for lamps, decreasing to six cents for power purposes. As electricity is generated by water power, and coal is cheap, the petitioners think the prices should be materially reduced, and have asked the Railroad Commission to fix the prices as follows: Arc lamps, $40 each per year; incandescent, $15 each; electricity to the city for lamps and motors, 6 cents per kw-hour; to private consumers, 7 cents per kw-hour, with a discount of 10 per cent.

LA GRANGE, GA.—Contracts have been awarded for power plants for additions to the Unity Cotton Mills, of La Grange, and the Manchester Cotton Mills at Manchester, Ga., as follows: For engines of about 800 hp and 1000 hp to Hooven-Owens-Rentschler Company, of Hamilton, Ohio; for engine-driven exciter sets to the Harrisburg Foundry & Machine Company; to the General Electric Company, of Schenectady, N. Y., for generators; Dean Brothers Steam Pump Works, Indianapolis, Ind., for pumping and condensing machinery, and R. D. Cole Manufacturing Company, of Newnan, Ga., for boilers, tanks, etc. Fuller E. Callaway, of La Grange, is president of both companies.

MOUNTAINTOWN, GA.—Application has been filed in the Superior Court by William M. Scott, E. W. Watkins, Sr., and E. W. Watkins, Jr., for a charter for the Coosawattee & Mountaintown Rivers Power & Improvement Company. The company proposes to develop the water power on the above-named rivers to generate electricity to be transmitted to neighboring towns. The company will be capitalized at $50,000.

VALDOSTA, GA.—The citizens have voted to issue $50,000 in bonds for the construction of an electric light plant in connection with the water-works system; and for extension to the water-works system, sewers and streets.

WRIGHTSVILLE, GA.—John W. Jordan, of Wrightsville, Ga., writes that he has a contract for a combined water works and electric light plant to be equipped with an 80-kw, 2300-volt, 60-cycle alternator, one 100-hp engine, one 125-hp boiler, heater and feed pump, one fire pump and air compressor, and also transformer for about 1200 lamps, and would like to receive prices on the above machinery.

TWIN FALLS, IDAHO.—Surveys are being made for the proposed electric railway from Twin Falls to the site selected for the new steel bridge across the Snake River Canyon, just below the Shoshone Falls. R. S. Cookingham is engineer.

BELLEVILLE, ILL.—A mortgage for $600,000 has been filed in the recorder's office by the St. Louis & St. Libory Railroad Company to secure an issue of bonds, the proceeds to be used to construct and equip a railway to extend from the Mississippi River through St. Clair County to St. Libory. Edward L. Thomas, of St. Louis, Mo., is president of the company.

CAIRO, ILL.—The Cairo Electric & Traction Company is constructing a power house in Cairo which will supply electricity for lamps in this city and for operating the cars of the Cairo & St. Louis Railway Company. The equipment will include three 400-hp Sterling boilers, which are now being installed; one 500-kw, 2300-volt, three-phase, Curtis turbine; one 750-kw, 600-volt, direct-current generator set, and a 300-kw motor generator set. The company will also repair and improve the present railway lines and equipment. The construction of an interurban railway nine miles long, connecting Cairo, Mound City and Moundsville is now under construction.

CHICAGO, ILL.—Arrangements are being made to extend the Oak Park Elevated Railroad from Harlem Avenue to Elmhurst, a distance of four miles.

WINNETKA, ILL.—Bids will be received by F. E. Herdman, manager of the municipal electric light plant and water-works system, until May 4 for two water-tube boilers, each with a rating of 200 hp, to be erected complete with all steam attachments in the municipal plant; also for boilers of 250 hp. Bids will also be received at the same time for two mechanical stokers of 200 hp each to be erected and operated in connection with the water-tube boilers; also for stokers of 250 hp.

BRAZIL, IND.—The controlling interest of the Brazil Electric Company has been purchased by a syndicate, of which F. M. Fauvre, of Indianapolis, Ind., is at the head. It is proposed to furnish electricity for lamps and motors to cities between Indianapolis and Terre Haute. The local plant has an output of about 1000 hp, which it is understood will be increased to 1500 hp by next fall to supply electrical service in this city and also in Greencastle. The company is also erecting a temporary plant in West Terre Haute to supply electricity in that city and surrounding territory. The plant will have an output of about 450 hp and is to be completed by the first of June, but later the output of the plant will be greatly increased. The company has about 1000 acres of coal lands in Vigo County, directly bordering Terre Haute, which will supply fuel for plants.

CRAIGVILLE, IND.—David and Andrew Worling have purchased the Craigville Telephone Company's plant. William Pennison, of Fort Wayne, has been employed to superintend the improvements, including extensions and new equipment to be made by the new owners.

EVANSVILLE, IND.—Bids will be received by the Board of Water Works until May 3 for the installation of an electric crane.

HUNTINGTON, IND.—The City Council has authorized the advertisement for bids for two new boilers and a dynamo for the municipal electric light plant. The new equipment will furnish electricity for 123 new street lamps. The city contemplates rebuilding and re-equipping the entire lighting system eventually.

LINTON, IND.—A spirited contest is on for the purchase of the local municipal electric light plant, now under lease to private parties. A syndicate headed by Mr. Ellis has offered $23,000 for the plant and a franchise. Mr. Ellis promises to dismantle the present power house and build a larger power plant about a mile distant, located at the mouth of a coal mine, and give a 24-hour service. On the other hand, Mr. Heath, of Chicago, is representing a company that will submit a proposition to the Council for the purchase of the plant under an agreement to reconstruct and re-equip the plant.

PRINCETON, IND.—The Princeton Independent Telephone Company is in the market for poles, wire and other material for the construction of a telephone line from Princeton to Owensville.

ROCHESTER, IND.—The capital stock of the Rochester Electric Light & Power Company has been increased from $50,000 to $150,000. John E. Beyer is president.

SOUTH BEND, IND.—The Manufacturers' Utility Company is planning to erect water and electric power plants along the St. Joseph River, for the purpose of furnishing electrical and water power to manufacturers. R. U. Miller, John Thomas and August Nelson are directors.

VINCENNES, IND.—The holdings of B. G. Hudnut and associates in the Vincennes Traction & Light Company have been purchased by S. S. Bush and S. A. Culbertson, of Louisville, Ky., and others, who are interested in the Rome Railway & Light Company, Rome, Ga.; the Pascagoula Street Railway & Light Company, Scranton, Miss., and the Jackson Railway & Light Company, Jackson, Tenn. The new officers of the Vincennes Traction & Light Company are as follows: S. A. Culbertson, president; S. S. Bush, vice-president and general manager, and Attilla Cox, secretary and treasurer.

VINCENNES, IND.—Bids will be received by the Board of Public Works until June 8 for lighting the streets, alleys and other public places in the city for a term of 10 years with 260 arc lamps of 2000 cp. In addition to furnishing the arc lamps specified, the contractor is to erect and have ready for use on April 29, 1910, not less than 220 incandescent lamps of 16 cp. The contractor is also to bid on furnishing electricity for lighting the public buildings. C. L. V. Tucker is clerk of the board.

DYERSVILLE, IA.—The Luxemburg & Millville Telephone Company is making arrangements to install its telephone system.

IOWA CITY, IA.—Plans are being made for the construction of a new electric light plant in Iowa City, for which a franchise has been secured. Franklin Benjamin, of Galesburg, Ill., is interested in the project.

LAWTON, IA.—The Lawton Telephone Company has made application for permission to increase its capital stock from $2,000 to $9,000.

FORT SCOTT, KAN.—Preparations are being made by the Fort Scott Gas & Electric Company to commence work on extensions and improvements to its system, which will involve an expenditure of about $80,000. F. D. Martin is manager.

HIAWATHA, KAN.—The North East Kansas Telephone Company has increased its capital stock to $20,000. F. M. Pearl is president.

LAWRENCE, KAN.—J. D. Bowersock has awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for a 250-kw electric generator. Mr. Bowersock contemplates installing a 750-kw generator if granted a franchise for a street railway system.

WATHENA, KAN.—The citizens have voted to issue $7,000 in bonds for the construction of an electric light plant.

BIDDEFORD, MAINE.—The York Light & Heat Company is making arrangements to erect a transmission line to Furness Rocks.

BRUNSWICK, MAINE.—The flume in connection with the plant of the Brunswick Electric Light & Power Company has been washed away by the flood putting the plant out of commission. The company is furnishing electricity through its auxiliary steam station. Electrical energy for operating the arc-lighting system is furnished from Cabot Mill station. Repairs cannot be made to the plant until the water subsides.

BALTIMORE, MD.—Proposals will be received by the Board of Awards until May 5 for furnishing the Electrical Commission with 1,000,000 ft., more or less, of vitrified tile conduit; 200,000 ft. of special duct pipe, including bends, according to specifications issued by the chief engineer of the commission. Samples of vitrified tile conduit and special duct pipe and bends must be submitted at least five days before the date of the opening of the bids. For specifications and further information apply to Charles E. Phelps, chief engineer.

BERLIN, MD.—Bids will be received by the Mayor and the Council until May 4 for furnishing and installing material and machinery for a gas producing power plant. Specifications and drawings will be furnished upon application to the Mayor and Council.

CAMBRIDGE, MD.—The Peninsula Traction Company, which proposes to construct a system of electric railways through the Eastern Shore counties is making plans to have part of its system in operation by fall. The present plans of the company contemplate the construction of an electric railway from Claiborne to Ocean City, passing through St. Michaels, Easton, Hurlock, Vienna, Salisbury, and Berlin. Another railway will extend from Cambridge through East Newmarket, with a branch to Secretary, crossing the main line at Hurlock, thence to Federalsburg, to the Maryland line and to Seaford, Del. The road will be 120 miles long and will cost about $2,500,000. The McKay Engineering Company, of Baltimore, Md., has charge of surveys for the company. The main power house will be located in Cambridge. Four substations will be erected along the line as follows: One between Easton and Hurlock, one at Vienna, one at Hurlock and another at Berlin. John H. Burgess, Jr., of Cambridge, and T. Hughlett Henry, of Easton, Md., are reported to be among those interested in the project.

HAGERSTOWN, MD.—Water rights at the mouth of the Antietam Creek, the site of the old Antietam Iron Works, below Sharpsburg, have been purchased by Pennsylvania capitalists. It is said that an electric light and power plant will be erected to furnish electricity to operate an electric railway over the Antietam battlefield.

BERNARDSTON, MASS.—The citizens are considering the question of lighting the village by electricity. G. W. Lawrence, treasurer of the Greenfield Electric Light & Power Company, has submitted a proposition offering to furnish the service provided sufficient business is guaranteed to pay the company to extend its transmission lines to the town.

BOSTON, MASS.—A special meeting of the stockholders of the Edison Electric Illuminating Company, of Boston, will be held April 29 to vote on the proposition to authorize the purchase of the electric lighting property of the following companies: Chelsea Gas Company, Boston Consolidated Gas Company, Newton & Watertown Gas Light Company, Waltham Gas Light Company and the Lexington Gas & Electric Company.

DUDLEY, MASS.—The citizens have voted to authorize the Selectmen to make a five-year contract with the Webster Gas & Electric Company for lighting the streets of the town.

ERVING, MASS.—The question of lighting the town by electricity is under consideration.

GARDNER, MASS.—It is understood that the Connecticut River Power Company, which has purchased the plant of the Gardner Electric Light Company, will not formally take over the plant, but will have a working agreement whereby the former company will furnish electricity to operate the plant. All motors now in use will be replaced by 60-cycle machines. H. H. Taylor is superintendent.

STOCKBRIDGE, MASS.—The Selectmen have granted the Stockbridge Lighting Company permission to extend its transmission lines through Goodrich Street; also other locations in Stockbridge and Glendale; in all about 30 lamps will be added to the street lighting system. The company contemplates extending its system to Interlaken in the near future.

STOUGHTON, MASS.—It is reported that the Edison Electric Illuminating Company, of Brockton, Mass., will acquire the plant and holdings of the Stoughton Gas & Electric Company.

WESTFIELD, MASS.—The citizens have voted in favor of the proposition to appropriate $25,000 for increasing the output of the municipal electric light plant. An additional generator and engine will be installed.

ANN ARBOR, MICH.—The Michigan & Ohio Railway Company has applied to the City Council for a franchise through the city. The company proposes to construct an electric railway between Toledo and Ann Arbor, which will probably be extended to Whitmore Lake and Lakeland.

FLINT, MICH.—Extensive improvements are contemplated by the Oak Park Power Company to its power plant, which will include the installation of six boilers, two turbines, switchboard, gas plant, pumps, stokers, etc. Contracts have already been placed for the above equipment. H. Dalton is secretary and manager.

IRONWOOD, MICH.—Work has commenced by the Twin City General Electric Company on the proposed extension of its street railway system from Ironwood to Bessemer, Ramsey and Wakefield, and also on the Jessieville extension. H. F. Pearce is general superintendent.

MANISTEE, MICH.—The Board of Supervisors is considering the question of granting a franchise to the Manistee County Electric Company to develop the water power of the Manistee River.

ALBERT LEA, MINN.—The Albert Lea Light & Power Company has commenced work on improvements to its electric light and gas systems, which will involve an expenditure of from $65,000 to $75,000. The equipment will include a 700-hp steam turbine, switchboard, installation of alternating-current system in the residential district, and extension of gas mains.

FERGUS FALLS, MINN.—The citizens have voted to issue $5,000 in bonds for extension to the electric lighting system.

HAWLEY, MINN.—The citizens have voted in favor of lighting the village by electricity.

ST. PAUL, MINN.—The capital stock of the Stevens County Telephone Company has been increased from $15,000 to $40,000.

WARREN, MINN.—Bids will be received until May 11 for a 125-hp internal furnace boiler for 160 lb. working pressure. Plans and specifications are on file at the city recorder's office. W. R. Haney is superintendent of water and light department.

COLUMBUS, MISS.—The Tombigbee Cotton Mills, the Columbus Underwear Mills and the Columbus Comfort Factory, of this city, it is reported, will combine and construct an electric power plant to operate the three mills.

HATTIESBURG, MISS.—Contracts have been awarded by the Hattiesburg Traction Company for the construction of a new power plant and the completion and equipment of eight miles of street railway to the Electrical Installation of Chicago, Ill. The company owns the present light and power plant. The work will involve an expenditure of about $150,000. C. Z. Stevens is general manager.

MT. OLIVE, MISS.—The citizens on April 18 voted in favor of establishing a municipal electric light plant.

EL DORADO SPRINGS, MO.—The citizens have voted to grant a franchise to B. F. Proctor to install and operate an electric light plant in El Dorado Springs.

RICHWOOD, MO.—The capital stock of the Richwood Telephone Company has been increased from $50,000 to $65,000.

SEDALIA, MO.—Bids will be received by the City Council for lighting the streets and public places of the city for a term of 10 years from Nov. 1, 1909, with magnetite arc lamps. J. L. Babcock is president of the Council.

CENTRAL CITY, NEB.—The question of establishing a municipal electric light plant is under consideration and will probably be submitted to a vote of the people.

DILLON, NEB.—The citizens have voted in favor of the proposition to issue bonds for the construction of a municipal electric light plant.

LINCOLN, NEB.—The Omaha, Lincoln & Beatrice Railway Company is erecting a distributing station, at a cost of about $4,500, at Bethany Heights to supply the town with electricity for lamps and motors.

LONG PINE, NEB.—S. H. Kyner is contemplating installing electrical equipment in his mill to light the village.

TABLE ROCK, NEB.—Preliminary arrangements are being made for the organization of the Table Rock Electric Light Company, which proposes to furnish electricity in Table Rock. Electricity for operating the system will be transmitted from the plant of O. A. Cooper & Son, of Humboldt, eight miles distant. The company will be capitalized at $6,500. Dr. E. L. McCrea was elected temporary chairman, and C. J. Wood as secretary.

WESTERN, NEB.—The citizens at a recent election voted to issue bonds for the establishment of a municipal electric light plant.

GOLDFIELD, NEV.—A company which will be known as the Chafey Mines has been organized to take over the famous Black Hole Mine. The company is planning to make several improvements, including the installation of another stamp mill, a power plant and a tramway from the mine to the mill sites.

EAST TILTON, N. H.—The Village Improvement Society is considering the question of lighting the town by electricity, and has appointed a committee to circulate a petition to have the Selectmen to call a town meeting for the purpose of forming a precinct to be lighted.

KEENE, N. H.—The Keene Gas & Electric Company is erecting a transmission line from the Ralston Street power station to the power house of the electric railway in South Keene. A motor is also being installed in the South Keene station.

LACONIA, N. H.—The State Legislature has passed a bill to light Endicott Rock and the bridge connecting it with the mainland by electricity.

LITTLETON, N. H.—It is reported that Chicago capitalists are interested in a project for the development of water power on the Connecticut River, involving an expenditure of between $5,000,000 and $6,000,000. The plan provides for the construction of three dams, one of which would be 160 ft. high, to be located at Lower Waterford, Vt., Monroe and Dalton, with a separate power plant in each town. C. E. Everett, Carl A. Ross, A. Danville, all of Chicago, Ill., and F. H. Gilbert, of New York, N. Y., are among the party making investigations.

MANCHESTER, N. H.—The State Legislature has given the Amoskeag Manufacturing Company authority to construct a dam below Goff's Falls and to lay cables and erect transmission lines for the transmission of electricity to the company's mills.

MANCHESTER, N. H.—The City Council has passed the ordinance authorizing the Mayor and committee on lighting to execute a contract with the Manchester Traction, Light & Power Company to furnish electricity for the 10 arches erected across Elm Street for ornamental lighting. Under the terms of the contract the company agrees to furnish electricity for the lamps in the arches at the rate of 6 cents per kw-hour, and 16 cents for each 16-cp lamp the company may furnish for the arches.

WOODSTOCK, N. H.—The citizens on May 11 will vote on the proposition to install a municipal electric light and power plant, using the dam of the Woodstock Lumber Company across the Pemigewasset River to furnish power to operate the plant. The cost of the plant is estimated at $14,000. L. F. Parker is chairman of town committee, and Arthur W. Dudley of Manchester, N. H., is engineer.

BRIDGETON, N. J.—The City Council has appointed a committee to investigate the question of establishing a municipal electric light plant.

TRENTON, N. J.—Negotiations have been closed whereby Charles R. Le Compte, Harry J. Terwilliger, Ernest Le Compte, Nicholas MacDonald, of Lakewood, N. J.; James H. Butcher, J. Arthur Butcher, of Ardena, and Captain R. A. Clark, of Point Pleasant, N. J., have taken over the property and franchises of the Trenton, Lakewood & Atlantic Railway. About four miles of the railway has been built between Point Pleasant and Lakewood. It is said that the new company will complete the railway at once between Point Pleasant and Lakewood and extend it to Trenton, via Allentown.

SANTA FE, N. M.—The application of Ernest Fischer, of Cimarron, N. M., for diversion of the waters of Pecos River and Holy Ghost Creek, 30 miles east of Santa Fe, for power purposes has been approved by Vernon L. Sullivan, territorial engineer. It is proposed to erect a power plant just below the mouth of the Macho, where 4500 hp will be developed to supply electricity in Albuquerque, Santa Fé and Las Vegas. A 5-ft. pipe line six miles in length, besides the cement-lined ditches, is included in the project. The cost of the entire work is estimated at about $450,000.

BUFFALO, N. Y.—On the ground that no definite data is at hand as to the probable cost of lighting the city and county hall with electricity, Mayor Adam has vetoed the ordinance of the Common Council calling for a bond issue of $37,500 for the purpose of paying the city's half of the expense of installing an electric light plant in the building.

GENEVA, N. Y.—The Common Council has directed the Board of Public Works to prepare and submit plans for a municipal conduit and pole system for the distribution of electricity in Geneva, with estimates of cost.

MONTICELLO, N. Y.—The Village Board has granted a franchise to the Ulster Lake Company, of Ellenville, N. Y., to erect transmission lines and furnish electricity in Monticello. The company claims that it can furnish electricity for 25 per cent less than is now being paid for the service. Dwight Devine & Sons are interested in the Ulster Lake Company.

NEW YORK, N. Y.—Bids will be received until May 3 by C. B. J. Snyder, superintendent of school buildings, Department of Education, for completing and finishing the installation of electric equipment in new Public School No. 89, Elmhurst, Borough of Queens, in accordance with the original plans and specifications of contract awarded to L. F. Benn, which has been declared abandoned.

NICHOLLVILLE, N. Y.—A 300-kw generator will be installed in the plant of the Nichollville Electric Light Company, which was recently damaged by fire. The water wheels were not damaged.

PORT JERVIS, N. Y.—The incorporation of the Port Jervis Light & Power Company is said to be part of the plan of the bondholders' committee to organize two companies to take over the public service properties in this city, which were recently sold at a foreclosure sale. The Port Jervis Light & Power Company will furnish gas and electric service, and a company to be known as the Port Jervis Traction Company is being organized to operate the street railway. The new companies will take over the securities of the present company and will apply to the Public Service Commission for permission to issue stock.

SHELDRAKE, N. Y.—The power house, heating plant and pumping station at the Sheldrake Springs Sanitarium was totally destroyed by fire on April 20, causing a loss of about $10,000. It is said that the plant will be rebuilt immediately.

SOUTHOLD, N. Y.—Application has been made to the Town Board by John E. Root, George W. Reeves, Frederick E. Lewis, George F. Stackpole and J. Madison Wells for permission to construct and operate a street railway from Riverhead through Southold to Orient Point.

WARREN, N. Y.—The Warren County Traction Company has filed a mortgage in favor of the Banker's Corporation, of Reading, Pa., for $500,000. The company is planning to extend its railway from Youngsville to Warren.

BEAUFORT, N. C.—The contract for machinery and distributing system for the municipal electric light plant has been awarded to E. A. O'Bryan, Wilmington, N. C.; inside wiring is to be done by H. W. Westbrook, Mt. Olive, N. C. Richard Rice is Mayor.

CHARLOTTE, N. C.—Work has commenced on grading the railway for the Burgraham Interurban Company, which will connect Burlington, Graham and Haw River. The Southern Power & Traction Company, recently chartered, and which has secured franchises in Burlington, Graham, Reidsville, Wentworth and other towns, is being promoted by the same parties who are engaged in the construction of the above road.

WAKE FOREST, N. C.—The citizens have voted to issue $15,000 in bonds, the proceeds to be used for the construction of an electric light plant for the college and city.

GRAND FORKS, N. D.—The County Board of Commissioners has granted the Grand Forks Street Railway Company a franchise to construct a railway to the fair grounds and the cemetery.

NORTON, N. D.—The Norton Telephone Company has increased its capital stock from $10,000 to $30,000.

BELLEFONTAINE, OHIO.—The capital stock of the Logan County Farmers' Telephone Company has been increased from $5,000 to $15,000.

COLUMBUS, OHIO.—Proposals will be received at the office of the Board of Trustees, of the Ohio State University, Columbus, Ohio, until May 10, for furnishing materials and erection of an addition to the power house at the State University, in accordance with plans and specifications prepared by Herbert Edwards, of Columbus, Ohio. Plans can be seen at the above office or at the office of the architect. Carl E. Stees is secretary of the board.

DEFIANCE, OHIO.—The new owners of the plant of the People's Gas & Electric Company have submitted a proposition to the City Council offering to expend $50,000 in rebuilding the plant if granted a new franchise and lighting contract.

LIMA, OHIO.—Bids will be received by the Board of Public Service for lighting the streets of the city until May 13. The bids received Feb. 20 were rejected. A. W. Thomas is clerk of the board.

PATASKALA, OHIO.—The capital stock of the Pataskala Farmers' Telephone Company has been increased from $30,000 to $50,000.

SPRINGFIELD, OHIO.—It is reported that John L. Zimmerman, president of the Springfield Light, Heat & Power Company, and other officers are negotiating for the purchase of a site for a power house.

SPRINGFIELD, OHIO.—We are asked to announce the fact that the People's Light, Heat & Power Company ceased to exist after Oct. 1, 1908, and its property is now owned and operated by the Springfield Light, Heat & Power Company. The last named company also absorbed the plant and holdings of the Home Lighting, Power & Heating Company, of Springfield. A. N. Cope is general superintendent.

TOLEDO, OHIO.—Bids will be received at the office of the Board of Public Service until May 22 for furnishing and erecting two duplicate electric generators with a rating of 100 kw each; also for two vertical, three-cylinder producer gas engines direct connected to the above generators, together with the necessary piping, tools, etc. Bids will also be received for switchboard consisting of three main panels and three subpanels, together with all instruments, switches, electric cables, etc. The above machinery and equipment is to be erected in the low-service pumping station on the grounds of the filtration plant of the city of Toledo. Copies of the plan showing the location of the machinery and the gas main in the low-service pumping station, also copies of the specifications, forms of proposals, forms of bonds, and form of contract can be secured on and after May 1 on application to the chief engineer of the Board of Public Service, Valentine Building, Toledo, Ohio, upon deposit of $10, which will be returned upon return of said plans, specifications in good order, before June 1, 1909. Bidders must use printed forms, as none other will be received. George W. Tonson is president of the Board.

XENIA, OHIO.—The County Commissioners have granted a franchise to Thomas L. Ferneding, for the construction of an electric railway between Xenia and Dayton. The franchise will be transferred to the Dayton, Springfield & Xenia Southern Traction Company, incorporated last winter, which proposes to extend the railway to Washington, C. H.

ZANESVILLE, OHIO.—Plans are being considered to reorganize the Central Valley Light & Power Company for the purpose of constructing an electric railway between this city and McConnellsville to connect with the Parkersburg-Marietta railway, which is now being extended up the Muskingum from Marietta, and which will ultimately be extended to McConnellsville. The charter of the Center Valley Company, which originally provided for the construction of a power house, will have to be amended to secure the privilege of building the railway. Rufus C. Barton is one of the directors.

EL RENO, OKLA.—It is reported that the Oklahoma City Chamber of Commerce has agreed to raise the sum of $50,000 for the El Reno Interurban Railway, which proposes to construct an interurban electric railway between Oklahoma City and El Reno, a distance of 25.5 miles. It is said that the company will commence work as soon as the $50,000 has been raised. Henry Schaefer, of El Reno, is president.

SAPULPA, OKLA.—At the coming election the citizens will vote on the proposition to issue $40,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system.

JOSEPH, ORE.—Having secured a 30-year franchise from the City Council, the St. Joseph Electric Light & Power Company contemplates increasing the output of its plant. The plant is to be operated by water power.

PORTLAND, ORE.—The City Council has granted the Portland Railway, Light & Power Company a blanket franchise to construct and operate several new lines, spurs and switches in this city.

BLOOMSBURG, PA.—It is stated that the Columbia Power, Light & Railways Company will place contracts at once for the erection of a 23,000-volt, three-phase transmission line, 25 miles in length, with about 2000 kw of transformers, lightning arresters, etc. The company will also install a 500-hp hydraulic turbine, a 300-kw generator to supply electricity for railway service and a 200-kw belted generator with switchboard, etc. B. O. Ellis is general manager.

CALIFORNIA, PA.—Application will be made on May 10 for a charter for the California & Centerville Street Railway Company, which proposes to construct a street railway from California to Centerville. M. H. Francis, W. J. Weaver, H. C. Drum, Harris Booker and Joseph McLain are interested in the project.

FINLEYVILLE, PA.—The Finleyville Southern Street Railway Company will apply for a charter to construct an electric railway from Finleyville to Bentleyville, a distance of 14 miles. A. H. Anderson, S. C. Wilson, F. M. Hayden, T. M. Hayden, J. E. Hayden, and H. B. Hayden are interested in the enterprise.

GLASSPORT, PA.—Work will commence within 30 days on the proposed electric railway to be constructed by the Jefferson & Wilson Street Railway Company and the Peters Creek Street Railway Company, which will connect Glassport and Clairton. The railway will be about five miles in length and will cost approximately $300,000. It is expected to have the road completed by Dec. 1, 1909. W. G. Wilson, of Dravosburg, Pa., is president, and W. G. Weimer, secretary.

PITTSBURGH, PA.—Application has been made to the Governor for a charter for the Rapid Transit Subway Company, which proposes to construct and operate an underground passenger railway in Pittsburg. F. W. Mueller, W. E. Kusen, Paul H. Mueller, of Pittsburg, are the applicants.

PORTSMOUTH, R. I.—Application has been made by Henry C. Anthony, David J. White and John L. Borden to the Legislature for an act to incorporate the Portsmouth Electric Company for the purpose of furnishing electricity for heat, lamps and motors in the towns of Portsmouth and Middletown.

SUNBURY, PA.—The Sunbury & Northumberland Electric Railway Company contemplates the purchase of two second-hand rotary converters, of 1200-kw and 1150-kw, respectively, for two-phase, 60-cycle system.

PROVIDENCE, R. I.—The New York, New Haven & Hartford Railroad Company is erecting a large interlocking tower on Promenade Street. The cost of the electrical equipment is estimated at $75,000. Electricity for operating the station can be taken from four sources: From power house of the Providence, Warren & Bristol Railroad, Warren; the power plant at the Providence station, one of the power houses in the city and the storage batteries. It is expected to have the tower ready for service during the coming summer.

GEORGETOWN, S. C.—The Georgetown Railway & Light Company, recently incorporated, has purchased the plant and holdings of the Georgetown Electric Company and contemplates the construction of a local street railway system during the coming summer, for which a franchise has already been secured. H. C. Case is president.

SALUDA, S. C.—It is reported that Ladshaw, White & Cameron are planning to erect a power plant on Green River, about three miles from Saluda, which will furnish 50,000 hp. Three large dams will be constructed.

LITTLEBEND, S. D.—A telephone company has been organized to construct a telephone line to Onida. W. E. Jenkins, of Okobojo, is secretary.

MADISON, S. D.—The citizens on April 20 voted to issue $16,000 in bonds, the proceeds to be used for improvements to the electric light plant. William Rae is city auditor.

GREENVILLE, TENN.—P. C. Ottinger writes that he is not interested in the construction of a hydro-electric plant on the French River, as reported in the issue of April 22. Mr. Ottinger is reported to be interested in a proposed electric railway to connect Newport and Greenville.

LEXINGTON, TENN.—The City Council is considering the question of installing a municipal electric light plant and water-works system, for which estimates of cost will soon be asked.

MINERAL WELLS, TEX.—The street railway and lighting properties, known as the Mineral Wells Electric System, were sold recently at auction to D. T. Bomar, of Bomar & Bomar, of Fort Worth, Tex., for $75,000. The property consists of about six miles of street railway, an electric lighting plant, and a 30-ton ice plant. The system is not in operation and no definite plans have been made for resumption of business.

ROCKDALE, TEX.—The Rockdale-Florence Interurban Railway Company, it is reported, contemplates the construction of a power plant. H. C. Meyer is president.

SAN ANTONIO, TEX.—The Southwestern Telephone Company, it is said, will make extensive improvements to its local system, which will involve an expenditure of about $300,000, of which $50,000 will be used to erect a new exchange.

SNYDER, TEX.—The contract for the construction of an electric light plant has been awarded to Messrs. Brumbach & Couch, of Cleburne, Tex.

GREENVILLE, TEX.—The J. W. Maxey Company, of Houston, Tex., has been awarded the contract for engineering work on the Greenville electric light plant, for $60,000. W. A. Frazer is city clerk.

TAFT, TEX.—Arrangements are being made for the construction of an electric light plant, plans for which are being prepared by Alfred Giles, of San Antonio, Tex.

LA SAL, UTAH.—The La Sal Mountain Telephone & Electric Company has increased its capital stock from $15,000 to $50,000.

BETHEL, VT.—The power plant of the Bethel Electric Light & Power Company has been put out of commission owing to the upper raceway having been damaged by the floods, which will take several weeks to repair. Electricity for business places is furnished from the steam power plant of the Gaysville Electric Company, of Bethel, Vt.

ESSEX JUNCTION, VT.—The Burlington Electric Light & Power Company contemplates extending its transmission line from Essex Junction to Butler's, a distance of two miles.

COLFAX, WASH.—The County Commissioners have awarded the contract for the electric light plant for the county court house to Fairbanks, Morse & Company, of Spokane, Wash., for $1,420. The equipment will include a 9-hp gasoline engine, dynamo and storage battery.

EVERETT, WASH.—The Everett & Tacoma Railway Company, it is stated, has made surveys and secured practically all the right of way for its proposed electric railway from Everett to Snohomish, Issaquah, Seattle and Tacoma, a distance of 110 miles. It is understood that the road has been financed and that contracts for construction will be let about the first of June. O. E. Crossman is president, and E. Colburn, of Snohomish, is chief engineer.

NORTH YAKIMA, WASH.—It is reported that plans are being made by the Yakima Valley Transportation Co. to extend its railway into the Moxoe Country.

SEATTLE, WASH.—E. L. Blaine has made application to the County Commissioners for a franchise to construct and operate an electric railway between Renton and Issaquah, a distance of about 10 miles.

SOUTH BEND, WASH.—The County Commissioners have granted a franchise to the Ilwaco General Electric Company, to erect transmission lines and construct an electric railway from Ilwaco to Stackpole Harbor on Willapa Bay, a distance of 20 miles. The company proposes to furnish electricity for lamps in Ilwaco and Long Beach and to operate an electric railway between Ilwaco and Stackpole Harbor.

SPOKANE, WASH.—The Panhandle Electric Railway & Power Company has filed amendments to its charter, which provide for the con-

struction of an electric railway from Priest River, Idaho, to Priest Lake, thence up the river to the Canadian line; a railway from Spokane to Priest River is also proposed.

SPOKANE, WASH.—Albert M. Dewey, president of the Okanogan Electric Railway Company, states that French capitalists have taken over a bond issue of $3,000,000, the proceeds of which will be used to construct a railway from Nighthawk to a point near the head of the navigation on the Columbia River, a distance of about 75 miles. The railway will be extended east of Spokane and west of Seattle. The entire system will include more than 500 miles.

VANCOUVER, WASH.—An electric power plant is being installed in the sawmill of the Pittock & Leadbetter Lumber Company, the equipment of which will include a 315-hp McEwen tandem compound engine, a 250-kw generator; steam for operating the plant will be furnished from the boilers of the sawmill. The company will furnish electricity to operate the cars of the Vancouver Traction Company, which at present purchases electrical energy for its system from the Portland Railway, Light & Power Company, of Portland, Ore.

WASHGOUAL, WASH.—We are informed that work will begin on construction on the proposed dam of Washgoual River to be erected by Cottrell & Son in July. The dam will be located about 2½ miles from Washgoual. The cost of the plant is estimated at $10,000.

CABIN CREEK, W. VA.—C. K. McDermott, of Charleston, W. Va., is reported to be interested in a project to construct an electric railway to connect Cabin Creek and Boomer, W. Va.

GRAFTON, W. VA.—At the annual meeting of the Grafton Traction Company it was decided to extend the railway system to Flemington, a distance of 10 miles.

MARTINSBURG, W. VA.—The Tuscarora Valley Traction Company has applied for a franchise to construct and operate an electric railway to connect Hedgesville, Darkesville and other points. J. C. Anderson, of Norfolk, Va., is interested in the project.

WELLSBURG, W. VA.—Plans have been completed by the Wellsburg, Bethany & Washington Traction Company for an extension to its railway from Bethany to and across the State Line to Avella.

CAMPBELLSPORT, WIS.—The citizens are considering the question of purchasing the electric light plant owned by the Campbellsport Electric Light & Power Company, and operating it as a municipal enterprise. It is understood that the present owners are willing to sell the plant.

CUMBERLAND, WIS.—The capital stock of the McKinley Telephone Company has been increased from $500 to $10,000 and the headquarters of the company have been transferred from McKinley to Cumberland.

JEFFERSON, WIS.—The Copeland & Ryder Company is making preparations to install an electric power plant.

MILWAUKEE, WIS.—Plans are being made by the Pabst Brewing Company to commence work at once on the construction of a power plant at Cold Spring Avenue and Thirteenth Street at an estimated cost of $19,000.

SUSSEX, WIS.—The Lisbon Telephone Company has increased its capital stock from $720 to $5,000.

VICTORIA, B. C., CAN.—Financial arrangements have been completed for the development proposed by the Stav Lake Power Company and an announcement has been made that the company will be in a position to deliver 10,000 hp before the end of 1910. William McNeil is secretary.

WINNIPEG, MAN., CAN.—It is reported that the Great Falls Power Company is planning to develop the water power of the Winnipeg River and erect a power plant with an output of 180,000 hp. The canal, it is said, will cost $1,000,000. H. M. Byllesby, of Chicago, Ill., is reported interested in the enterprise.

WINNIPEG, MAN., CAN.—The Saskatchewan government has purchased the Bell telephone system in that province, consisting of the long-distance lines, local exchanges and equipment, and will take over the system May 1. The government already has a telephone system under construction.

LISTOWELL, ONT., CAN.—The citizens have voted in favor of the by-law to light the streets of the town by electricity with 265 lamps.

NEW HAMBURG, ONT., CAN.—The Metropolitan Railway Company, it is reported, contemplates constructing a railway which will extend from Stratford to Guelph.

NEW HAMBURG, ONT., CAN.—The town has decided to purchase $20,000 in capital stock of the People's Railway Company, which is capitalized at $1,000,000. Other municipalities will be asked to take stock in the company.

WINDSOR, ONT., CAN.—According to estimates it will cost the city from $125,000 to $130,000 to build a distributing station and transmission lines for Niagara power. The price for electricity from the Hydro-Electric Power Commission in amounts less than 5000 hp delivered at Windsor is $38 per hp per year, which, with the cost of the distributing system, would make the cost about $45 per hp per year.

LUMSDEN, SASK., CAN.—Arthur Anslow will receive tenders until May 8 for all work in connection with the construction of a system for the Wascana Rural Telephone Company.

SALTSCOATS, SASK., CAN.—Plans are being made by the Saltscoats District Telephone Company to erect about 50 miles of telephone line this season.

Company Elections.

OURAY, COL.—At the annual meeting of the Ouray Electric Power & Light Company the following named officers were elected: E. A. Phinney, president and manager; C. J. Sigfrid, vice-president, and L. G. Crosby, secretary.

KANSAS CITY, MO.—At a recent meeting of the directors of the Blue Valley Traction Company the following named officers were elected: M. M. Sweetman, president; C. W. German, secretary, and J. M. Lowe, treasurer.

HUNTINGTON, N. Y.—At the annual meeting of the Huntington Light & Power Company the following named officers were elected: Henry S. Brush, president; William J. Matheson, vice-president, and Douglass Conklin, secretary and treasurer.

New Industrial Companies.

THE CONTINENTAL ROYAL PHONE & PHONOGRAM COMPANY, of Kittery, Maine, has filed articles of incorporation with a capital stock of $5,000,000 for the purpose of manufacturing telephone and telegraph instruments. A. H. Peavey is president; G. E. Burnham, treasurer, and E. J. Burnham, clerk, all of Kittery, Maine.

THE ELECTRIC MANUFACTURING COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $25,000 by H. B. McGraw, M. C. Russ, W. P. Dunlany, K. B. Britton and C. A. Black.

THE EMPIRE VACUUM COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State, with a capital stock of $300,000, to manufacture vacuum cleaning apparatus. The incorporators are: George A. Kues, Frederick S. Bon and Charles W. Place.

THE FISHER DRILLING & ENGINEERING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $15,000, by Hamilton Anderson, F. Fassett Briggs and Louis F. Goldman, all of New York, N. Y. The company proposes to do a mechanical engineering business.

FITZGERALD & BENNIE LABORATORIES, of Niagara Falls, N. Y., has been incorporated, with a capital stock of $25,000, as consulting chemical and metallurgical laboratory. The incorporators are: Francis A. J. Fitzgerald, P. McNiven, B. and Delos R. Miller, all of Niagara Falls, N. Y.

THE GARNY-MEHSERLE MACHINE & AUTO COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $2,000 by George Garny, Theresa Garney, Henry Mehserle and Katherine Mehserle, all of Rochester. The company proposes to manufacture motors, engines, etc., cars and vehicles.

THE GEORGIA TIE & LUMBER COMPANY, of Matteawan, N. Y., has been chartered, with a capital stock of $250,000, by John B. Ecleston, of New York, N. Y.; Samuel C. Ecleston and Arthur A. Mitchell, of West New Brighton, N. Y. The company proposes to manufacture railroad ties, poles and cross-arms for railroads, electric light companies and others.

THE INTERSTATE RAILWAY & STEAMSHIP SUPPLY COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $20,000, to manufacture engines, boilers, machinery, boats, electric motors and dynamos. The incorporators are: Thomas F. Fallon, William Hyland and Matthew M. Feely, all of New York, N. Y.

THE JEWEL ELECTRIC COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $15,000, to manufacture electrical supplies by Robert J. Phillips, Miles C. St. John and Milo C. Diller.

THE JOHN J. GIBSON COMPANY, of Buffalo, N. Y., has been incorporated, with a capital stock of $20,000, by Joseph N. Gregory, E. G. Thompson and George Roughhead, Jr., all of Buffalo, N. Y. The company proposes to manufacture motors, engines, machines, cars, automobiles, etc.

THE LIGHTNING ELECTRIC ACCESSORIES COMPANY, of Chicago, Ill., has been incorporated by Messrs. Hornstein and Fisher, Fort Dearborn Building, Chicago. The company is capitalized at $2,500 and proposes to manufacture automobile and electric accessories.

THE McLEER ELECTRIC & MANUFACTURING COMPANY, of Brooklyn, N. Y., has been incorporated by Charles B. McLeer, Joseph McLeer, Jr., and Edward McLeer, Jr., all of Brooklyn, N. Y. The company is capitalized at $20,000 and proposes to do general contracting and electrical work.

THE STANDARD CHEMICAL COMPANY, of Bayonne, N. J., has been chartered with a capital stock of $100,000 for the purpose of manufacturing materials pertaining to insulation. The incorporators are: Philip S. Smith, of Philadelphia, Pa.; Dorris Whipple and Charles H. Toping, of New York, N. Y.

THE STOUGHTON-FOLKINS COMPANY, of Portland, Maine, has filed articles of incorporation, with a capital stock of $10,000, for the purpose of manufacturing motors, engines and vehicles. M. S. Folkins is president, and P. T. Stoughton, clerk and treasurer, both of Portland, Maine.

THE WESTERN MANUFACTURING COMPANY, of Newark, N. J., has been incorporated with a capital stock of $125,000 by Christian H. Westen, Daniel W. Applegate, Burton L. R. Hare, of Newark, N. J.

The company proposes to do a mechanical and electrical engineering business.

THE WILBUR-ROSS LIGHT & CHEMICAL COMPANY, of Wilmington, Del., has been chartered, with a capital stock of $25,000, by F. M. Shive, S. E. Roberson and Harry W. Davis, of Wilmington, Del.

New Incorporations.

RAUM, ARK.—The Northern Arkansas & Missouri Valley Telephone Company has been organized and the following-named officers elected: A. Winkle, president; W. O. Fox, secretary, and T. J. Davis, treasurer.

BAKERSFIELD, CAL.—The Farmers' Mutual Telephone Company has been chartered, with a capital stock of $4,000, by W. W. Frazier, R. S. Ashe, D. Hirschfield, Milo G. McKee and James Herod.

GLENDALE, CAL.—Articles of incorporation have been filed for the Glendale & Eagle Rock Railway Company to construct a railway 2½ miles in length, to be operated by electricity or gasoline. The company is capitalized at $25,000 and the directors are: E. D. Goode, R. E. Goode and George Benson.

RED BLUFF, CAL.—Articles of incorporation have been filed with the county recorder for the Sierra Electric Company. The directors of the company are F. E. Horton, of Berkeley, Cal.; B. F. Woolmer, T. C. Warren and Boyd L. Wilson, of Oakland, Cal. The capital stock is placed at $500,000.

RED BLUFF, CAL.—The Tehama Power Company has filed articles of incorporation with a capital stock of $10,000,000, and will develop a water power on Mill Creek in Tehama County. The directors are: Luke McDonald, of Redding; L. A. McIntosh, of Chico, Cal.; R. S. Kitrick, of Oroville, Cal.; J. E. Frick, of San Francisco, and Leon Ely.

BRANFORD, CONN.—The Senate has passed the resolution incorporating the North Branford Light, Water & Power Company. The incorporators are: Joseph P. Manning, Charles H. Nichols, of New Haven, Conn.; Louis A. Fisk, Charles S. Bradley, of Branford; Robert O. Eaton, of North Haven, Conn.; Alfred D. Rose, of North Branford; J. Henry Roraback, of North Canaan, Conn., and Theodore H. Macdonald, of New Haven, Conn. The company is given the privilege to take water from the Twin Lakes, in North Branford, the Branford River and West River and tributaries.

GAINESVILLE, GA.—The New Bridge Telephone Company has been organized to construct a telephone line 12 miles in length. Claud L. Thompson is president, and W. L. Awtry, secretary and treasurer.

CHICAGO, ILL.—The Kendall County Telephone Company has been incorporated, with a capital stock of $25,000, by Lester Coffeen, F. W. Henickman and George T. Rogers.

CHICAGO, ILL.—The Northern Illinois Gas & Electric Company has been chartered, with a capital stock of $2,500, by E. J. Kloss, E. A. Munger and L. D. Condee. The company proposes to operate electric light plants.

EAST ST. LOUIS, ILL.—The St. Louis & Chester Railway Company has been incorporated with a capital stock of $100,000 to construct and operate a railway from East St. Louis to Chester, Ill. The incorporators are: R. Stecher, E. W. Ziegenhein and R. A. Slack, of East St. Louis.

GOLDEN, ILL.—Articles of incorporation have been filed for the Golden Farmers' Telephone Company, with a capital stock of $2,500, by Philip Cain, Scott Najor and C. G. Buss.

LOVINGTON, ILL.—The Farmers & Merchants' Telephone Company, of Moultrie County, has been incorporated, with a capital stock of $30,000, by W. O. Neff, E. O. Hood and A. E. Hanson.

OTTAWA, ILL.—Articles of incorporation have been filed for the United Telephone Company, of Ottawa. The company is capitalized at $120,000, and the incorporators are A. C. Schoch, Henry W. Johnson and Vincent J. Johnson, all of Ottawa.

STONE CHURCH, ILL.—The Northwestern Telephone Company has been chartered with a capital stock of $840 by H. B. Doeschen, Louis Lammers and Victor Grattendick.

YORKVILLE, ILL.—The Kendal County Telephone Company has been chartered with a capital stock of $25,000 by W. Lester Coffeen, F. W. Henicksman and George T. Rogers.

BUSHY PRAIRIE, IND.—The Farmers' Mutual Telephone Company has been incorporated to build a system in Bushy Prairie and throughout Lagrange County. Arthur K. Hammond, E. W. Ernsberger and Fred Seaburn are directors.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the Pretty Prairie Telephone Company, of Lagrange County. The company is capitalized at $4,000, and the incorporators are: F. G. Smeltzly, H. C. Plank, M. E. Homer, Amos Long and D. M. Plank.

MOORES HILL, IND.—The Moores Hill Telephone Company has been incorporated, with a capital stock of $150. The directors are M. C. Nulford, M. E. Bigney, S. J. Houston, John F. Givan and George W. Canfield.

MASON CITY, IA.—The Portland Heights Telephone Company has been incorporated, with a capital stock of $10,000. R. B. Pickford is secretary and treasurer.

OAKLAND, IA.—The Morgan & Oakland Township Telephone Company has been organized. The officers are: O. C. Sime, president; S. H. Russ, vice-president; Ole Sevick, secretary, and H. J. Iverson, treasurer.

WYOMING, IA.—The Wyoming Telephone Company has been chartered, with a capital stock of $30,000, by Otto Wettstein, Jr., W. D. Waggoner and J. J. Luneman.

MONTICELLO, MAINE.—The Monticello Electric Company has been organized with a capital stock of $5,000 for the purpose of generating electricity for light, heat and power purposes. The officers of the company are: Guy C. Fletcher, president; H. L. Hurd, treasurer, both of Monticello.

BARRYTON, MICH.—The Barryton Rural Telephone Company has been incorporated, with a capital stock of $1,000.

EAGLE LAKE, MINN.—The Midway Telephone Company has been incorporated, with a capital stock of $6,000. M. Benhardus is secretary and treasurer.

WEST CONCORD, MINN.—Articles of incorporation have been filed for the West Concord Telephone Company, with a capital stock of $15,000, by W. T. Schmidt, F. F. Clifford, J. G. McCarthy, E. E. Harrison and H. H. Orcutt.

HINSDALE, MONT.—Articles of incorporation have been filed for the Farmers' Telephone Company, of Hinsdale, with a capital stock of $20,000.

McLEOD, MONT.—The Maine Boulder Telephone Company has been incorporated, with a capital stock of $2,000.

O'NEILL, NEB.—The Michigan Telephone Company has been formed to build a telephone line to connect with Grattan and O'Neill, about 20 miles in length. M. P. Sullivan is president; J. D. Kelley, vice-president; P. C. Kelley, secretary, and Jacob Hirsch, treasurer.

ELY, NEV.—The Spring Valley Telephone Company has been incorporated by Henry C. Nicholson, Joseph Stevens and Eugene Giles.

RENO, NEV.—The Lander County Power & Light Company has been incorporated, with a capital stock of $200,000. The company proposes to construct and maintain electric light and power plants and to operate telegraph and telephone lines in the State of Nevada.

LAKEWOOD, N. J.—Articles of incorporation have been filed for the Lakewood & Seashore Railroad Company with a capital stock of $300,000, by Chas. R. Le Compte, of Lakewood, N. J.; Jas. H. Butcher, of Ardena; Ernest LeCompte, Harry J. Terwilliger, Nicholas MacDonald, all of Lakewood; and Frederick A. Clark, of Point Pleasant, N. J. The new company has purchased the property and rights of the Trenton, Lakewood & Atlantic Railroad Company, and proposes to construct an electric railway from Lakewood to Point Pleasant, a distance of 10 miles.

PORT JERVIS, N. Y.—The Port Jervis Light & Power Company has been incorporated, with a capital stock of $300,000, for the purpose of generating gas and electricity for lamps, heat and motors. The incorporators are J. E. Daily, J. D. Crowell and R. C. Maroney, of New York, N. Y.

WILTON, N. D.—The Grass Lake Mutual Telephone Company has been organized and the following officers elected: G. A. Hubbell, secretary; Oscar Backman, treasurer, and Gabriel Thor, general manager.

COLUMBUS, OHIO.—The Defiance, Napoleon & Wauseon Railway Company has filed articles of incorporation with a capital stock of $1,000 to construct and operate a railway between Wauseon and Defiance, the motive power to be steam, electricity or other power.

GILMORE, OHIO.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $2,000 by A. Parker, D. Galbraith, Aaron Parker, W. F. Roberts and T. J. McCue.

MAGNOLIA, OHIO.—The Farmers' Tri-County Telephone Company, of this place, has been incorporated with a capital stock of $5,000 by R. R. Elson, J. H. Meitzler, M. J. Cooper, W. H. Maddrell and F. M. Randells.

NEWARK, OHIO.—The Somerset Telephone Company has been incorporated by Edward Kibler, Harry Swisher, C. E. Hollander, R. S. Hunter and R. W. Smith. The capital stock is $25,000.

CLINTON, OKLA.—The Clinton Street Railway Company has been incorporated with a capital stock of $50,000 to construct a street railway in Clinton, 10 miles in length. The directors are: C. W. Goodwin, R. O. Hunt, M. L. Holcombe, Charles H. Lamb, E. N. Tittsworth, A. N. Curry, E. A. Humphrey, and B. A. Little, of Clinton, and H. Smith, of Arapahoe, Okla. The Clinton Railroad Construction has also been chartered by the same parties.

McARTHUR (P. O. HAMMON), OKLA.—The McArthur Telephone Company has been chartered, with a capital stock of $3,000. The directors are Henry Black, John Rogers and C. H. Godfrey, all of Texmo.

Personal.

MR. H. H. BARNES, JR., gave a lecture April 16 before the Pittsfield A. I. E. E. branch on "Electric Transportation Facilities in New York City." The lecture was illustrated with lantern slides.

MR. HENRY FLOY has been retained as consulting engineer for the St. Louis Smelting & Refining Company in the design and construction of a large extension to the company's plant at Collinsville, Ill.

MR. HAROLD ALMERT, the consulting and central station engineer of Chicago, has been visiting New York during the past week, in connection with various personal matters, and has returned to the West.

MR. W. CURRY TURPIN has resigned as superintendent of the Auburn Light, Heat & Power Company, to accept a position as electrical engineer with the New York Public Service Commission, First District.

MR. JEAN BART BALCOMB has resigned from the Lake Construction Company in order to take up practice as consulting engineer, with offices at 184 La Salle Street, Chicago. Mr. Balcomb will make a specialty of hydraulic and hydroelectric work.

MR. EDMUND LANG, for many years connected with the Wheeler Condenser & Engineering Company and other engineering companies, has been appointed to undertake some special work in shop organization for the Crocker-Wheeler Company, Ampere, N. J.

MR. E. O. GOCHICOA has resigned as superintendent of the Sultepec (Mex.) Electric Light & Power Company, and after a visit to some of the larger electrical works of this country will establish the firm of Gochicoa, Ohlhauser & Company, with headquarters at Toluca, Mex.

MR. DEWITT V. MOORE, vice-president of the Moore-Mansfield Construction Company, of Indianapolis, has been elected a director of the American Society of Engineering Contractors. This is a new organization recently formed in New York for the advancement of engineering knowledge and contracting practice and the maintenance of high professional standards among its members.

MR. W. B. POTTER, engineer of the railway department of the General Electric Company, is now fully recovered from his recent illness and operation, due to unusual effort and fatigue incurred during his long trip over the Pacific Slope, investigating power and traction conditions there. Mr. Potter has been under private treatment in New York City, but is now convalescent and resuming work, much to the pleasure of a host of friends.

MR. A. T. MACDONALD, the indefatigable secretary of the late Louisville Electrical Exposition, was the recipient at the close of the show of a silver service presented by the officers and exhibitors. The presentation was made after a mock trial in which Mr. Macdonald was condemned to hard labor in Louisville for the rest of his life. President Kieskers and Treasurer Beckman also received silver services in recognition of their services.

MR. CHARLES J. RUSSELL will represent the Philadelphia Electric Company at the seventh International Congress of Applied Electricity. The congress will be held in London, May 25 to June 2, and after the adjournment Mr. Russell will visit various plants in England, France, Germany and Switzerland, investigating the various industrial applications of electricity, with special regard to electrochemical and electrometallurgical processes.

PROF. WILLIAM C. BAUER has been appointed professor of electrical engineering in the new College of Engineering of Northwestern University at Evanston, Ill. Professor Bauer was born in Cincinnati in 1873 and was graduated from the University of Cincinnati in 1896. He specialized in physics, engineering and chemistry, and for a year was instructor in civil engineering in his Alma Mater after graduation. He was then employed by the Bullock Electric Manufacturing Company, and thereafter went to the Baker University at Baldwin, Kan., where from 1897 to 1908 he was professor of physics and chemistry. From 1899 to 1902 he was magnetic observer in charge of the Baldwin Magnetic Observatory of the United States Coast and Geodetic Survey. He installed the electric light plant for Baldwin University and also later the central steam-heating plant, as well as the municipal electric lighting plant for the city of Baldwin, of which he was superintendent for one year. In 1905 he was a post-graduate student in the University of Chicago, and since 1908 he has been professor of physics and electrical engineering in the University of Denver. He is a member of the American Chemical Society, the American Association for the Advancement of Science and the Kansas Academy of Science and has the honorary degree, awarded by Baker University, of Sc. D.

PROFESSOR L. A. HERDT, who for the past 10 years has been connected with the electrical department of McGill University, has been appointed head of this department in place of Dr. R. B. Owens, who has resigned. Professor Herdt pursued studies in mechanical and electrical engineering at McGill University, receiving the degree of Master of Engineering in 1894. He then studied at the Laboratoire Central d'Electricité, Paris, and at the Electrotechnical Institute, Montefiore, Belgium, receiving the degree of E. E. from the latter. After some years of practice in France and Canada Professor Herdt was appointed lecturer and afterward assistant professor of electrical engineering at McGill University. Since 1907 he has served as an associate professor of electrical engineering. Professor Herdt is a frequent contributor to the technical press on electrical subjects. He was a delegate from Canada to the meeting of the International Electrotechnical Commission at London in June, 1907. He has been active in the affairs of the Canadian Society of Civil Engineers, being a member of council and chairman of the electrical section. He is also a member of the American Institute of Electrical Engineers and an "Officier d'Academie" of France. Professor Herdt has carried on a great deal of research work, and his services as consulting engineer are much sought after. He is at present a member of the board of consulting engineers engaged on hydroelectric works for the city of Winnipeg, Man.

Trade Publications.

PRESSURE GAGES are outlined in a folder issued by the Industrial Instrument Company, Foxboro, Mass.

RAILWAY SIGNALS using the same means of indication by night as by day are described in a neat bulletin issued by the World Signal Company, Phillipsburg, Pa.

FANS.—The Pettingell-Andrews Company, Pearl Street and Atlantic Avenue, Boston, has issued a neat booklet in which are listed and described fans for desk, wall, ceiling, bracket and telephone-booth uses.

ICE-BREAKER.—The Harrison Safety Boiler Works have issued a pamphlet devoted to the Creasey ice-breaker, which is shown in a large number of illustrations, including one of an electrically driven combined breaker and ice-cream freezer. A section of the pamphlet with the title "Ice-Users' Handbook" contains information on freezing ice-cream, cold-storage temperature, specific heats, etc.

EXHAUST FANS driven by direct-current motors are described in bulletin No. 112 of the Crocker-Wheeler Company, Ampere, N. J. These fans are used for ventilating factories, offices, stores, schools, churches, hotels, restaurants and, in fact, wherever automatic ventilation is required. They are also used for drying lumber, hides, textiles and other materials requiring similar treatment.

DIRECTLY COUPLED DIRECT-CURRENT MOTORS are described in bulletin No. 113 of the Crocker-Wheeler Company, Ampere, N. J. These motors are used on lathes, hoists, bloom shears, big rolls and ammonia compressers. All important features of construction are clearly explained and are illustrated with photographs that give details of construction and others showing the motors installed for actual service.

SEARCH-LANTERNS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4657 devoted to the subject of search-lanterns for commercial use. This publication contains illustrations and descriptions of projectors of various types and sizes and goes more or less into detail. The use of projectors in connection with advertising purposes is constantly increasing and this bulletin will be found of special interest along this line.

ELECTRICITY IN BREWERY.—The advantages that can be obtained from the use of electric motors in breweries are well discussed in bulletin No. 111 of the Crocker-Wheeler Company, Ampere, N. J. This bulletin describes what is said to be the only brewery in the world in which all of the malt-handling machinery is electrically controlled from one place, namely, the plant of Peter Doelger, First Avenue and Fifty-fifth Street, New York.

TELEPHONE LINE INSULATING TRANSFORMER.—Booklet No. 3770 issued by the General Electric Company describes a piece of apparatus known as a telephone line insulating transformer designed to safeguard the users of telephones from the dangers of high voltage and to improve the telephone service by removing the ordinary small ground-gap carbon arrester from direct connection with the line. The booklet contains illustrations of the apparatus and its method of installation.

PORTABLE SERIES TRANSFORMERS.—In bulletin No. 4656 of the General Electric Company, Schenectady, N. Y., is described a series transformer for use in connection with the measurement of large values of current. These transformers are made in two forms—one contains both primary and secondary coils; the other contains only the secondary coil, the primary being composed of one or more turns of the cable carrying the current to be measured. They may be used on circuits the potential of which does not exceed 2500 volts. The transformers are portable and are provided with carrying handles.

Business Notes.

THE PARKER ELECTRIC COMPANY will, after May 1, have its offices in the Singer Building Tower, 149 Broadway, New York.

THE CLARK ELECTRIC & MANUFACTURING COMPANY will move its offices, May 1, to the Singer Building Tower, 149 Broadway, New York.

THE COLUMBIA METAL BOX COMPANY, 1941 Park Avenue, New York, has purchased the panel and switchboard department of the F. A. La Roche Company.

FRAZER & SALE, LTD., forwarding agents in the Oriental trade, have removed their offices from 63-65 Wall Street to the Hudson Terminal Building, 50 Church Street, New York.

MR. H. M. HIRSCHBERG, president of the Excello Arc Lamp Company, New York, sailed for Europe Saturday, April 24, on a short business trip to England and Germany, but will return in time to attend the electric light convention at Atlantic City on June 1.

THE DU BOIS IRON WORKS, Du Bois, Pa., has appointed Mr. James L. Kimball its New England representative, with offices at 53 State Street, Boston, Mass.; also the James F. Marshall Company, 608 Chestnut Street, Philadelphia, as general sales managers for Eastern Pennsylvania, Delaware and the southern half of New Jersey.

PELTON TURBINES FOR SCHAGHTICOKE GENERAL ELECTRIC PLANT.—The Pelton Water Wheel Company supplied the four

5000-hp Francis turbines used in the Schaghticoke hydro-electric station which generates electrical energy for the General Electric Schenectady works. The Pelton company also supplied the speed governors.

THE PLYMOUTH (MASS.) ELECTRIC LIGHT COMPANY'S power plant was damaged by fire on April 26, causing a loss of about $50,000. The generators and switchboard equipment sustained most of the loss, the injury to the building itself being comparatively slight. The company supplies Plymouth, Duxbury and Kingston with service and rushed emergency connections to get part of the system in operation on the evening of the fire.

THE INTERNATIONAL ELECTRIC METER COMPANY, of Chicago, has moved into new quarters at 110-112 North Sheldon Street. In its new factory the company has considerably more room than in the old location at 330 West Randolph Street, and it is now in position to take care of its increased business. The conditions for the manufacture of instruments in the new location are of the best, with ample provision for light and air, and the company announces that it is now better equipped than ever before to meet its customers' requirements.

PLANIGRAPH.—Messrs. Spon & Chamberlain, 123 Liberty Street, New York, are publishing the Herrick "planigraph," an instrument designed for quickly solving problems in copper conductors for electric circuits. It consists of a chart with four marginal shifting scales, one set for the calculation of branch circuits, one for mains and feeders, the third for railway circuits and the fourth for long-distance circuits. Any problems involving amount of energy, distance to be carried, volts, drop and size of wire required are readily solved.

THE CRESCENT COMPANY, 103 West Adams Street, Chicago, announces that it has taken the agency for the Dickinson Manufacturing Company, of Springfield, Mass., which makes a specialty of molded insulation, including composition and mica weatherproof sockets, socket bushings, composition socket rings, telephone receivers, receiver shells, mouthpieces, switch handles and socket keys. Recently it has developed an entirely new composition, known as "Gummon," which has a very high insulation resistance, and in addition is heatproof, oilproof, acid-proof and waterproof. This material is especially adapted for high-tension work, strain insulators and small parts where it is necessary to mold metallic pieces into the insulation.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 20, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

918,493. MULTIPLE SWITCH STARTER; T. E. Barnum, Milwaukee, Wis. App. filed May 20, 1907. A plurality of hand operating switches to control the motor resistance; the retaining magnet for holding the switch closed is controlled by a heat operated device when the resistance is left in circuit for longer than a predetermined period.

918,498. REVOLVING FIELD MAGNET STRUCTURE; B. A. Behrend, Norwood, Ohio. App. filed June 8, 1907. For field magnets driven at high speeds by turbine generators in which a polygonal core is used of high magnetic permeability having extensions for supporting it, all of one solid integral mass and field poles secured thereto.

918,499. FIELD MAGNET; B. A. Behrend, Norwood, Ohio. App. filed May 14, 1907. Revolving field magnets for dynamos used when driven by high speed turbines. Provides side supports for the windings and means passing into the pole pieces and between the windings for retaining the supports in position.

918,500. SEAL FOR ARC-LIGHT ELECTRODES; Edward R. Berry, Lynn, Mass. App. filed Sept. 28, 1908. The seal consists of a mass of electrode material and adhesive substance.

918,501. CONDUCTOR; G. W. Bolton, Jr., Detroit, Mich. App. filed Oct. 15, 1907. The conductor tip or clip is an open loop having contacting portions in a plane and another portion in a different plane.

918,513. PANEL CONSTRUCTION FOR SWITCHBOARDS; A. F. Dixon, New York, N. Y. App. filed April 25, 1908. For automatic telephone exchanges; having shallow grooves in its face with narrow strips of metal edgewise in the grooves having ears at intervals adapted to be engaged by contact brushes. Insulating material is flowed over the board into the grooves and hardened.

918,533. SPROCKET SUPPORT FOR ELECTRIC SAD IRONS; M. Griswold, Jr., Erie, Pa. App. filed May 6, 1908. The handle has at one end a hook and the iron has a plug on which the socket is detachably mounted.

918,535. ELECTRIC RESISTANCE UNIT OR ELEMENT; W. S. Hadaway, Jr., East Orange, N. J. App. filed June 15, 1908. A conducting ribbon with a plurality of slots on opposite edges, unequally spaced to locally increase the resistance.

918,537. TRAIN POSITION INDICATOR; O. Halvorsen, Schenectady, N. Y. App. filed March 23, 1908. For giving the position and rate of speed of trains. A series of electrical impulses are produced on the car which are received selectively so that they may be received on another car or at a station.

918,539. AUTOMATIC BLOCK SIGNAL SYSTEM; S. H. Harrington, New York, N. Y. App. filed Dec. 6, 1902. A signal with hydraulic means to operate it, the latter being controlled by a train.

918,540. RAILWAY SIGNALING DEVICE; S. H. Harrington, New York, N. Y. App. filed March 7, 1905. A block signal in which the circuits are independent of the rails and are carried by guy wires from suitable posts.

918,547. RESISTANCE UNIT; H. E. Heath, Lynn, Mass. App. filed Mar. 7, 1907. A resistance tube comprising similarly shaped strips of asbestos and conducting material spirally wound so as to overlap.

918,561. ALTERNATING-CURRENT SHUNT MOTOR; M. C. A. Latour, New York, N. Y. App. filed Aug. 17, 1907. An alternating-current motor of the commutating type, having means for supplying to the exciting winding of the motor shunt and series excitations, both dephased from the armature current of the motor.

918,566. TELEPHONE SYSTEM; R. H. Manson, Elyria, Ohio. App. filed April 18, 1907. Means for preventing a subscriber from ringing through the cord circuit at the exchange and operating the bell on the connected line circuit.

918,578. ELECTRIC REGULATOR; M. Moskowitz, New York, N. Y. App. filed March 12, 1908. Comprises vertically hung swinging links, magnets for actuating them, a dash pot and plunger, a cross arm connecting the links, the cross arm being connected to the dash pot.

918,594. DYNAMO ELECTRIC MACHINE; E. D. Priest, Schenectady, N. Y. App. filed Feb. 13, 1907. The armature is made up of laminæ carried directly on the shaft of the armature without the intervention of a sleeve.

918,596. MEANS FOR PROTECTING SUBMERGED MOTORS; H. G. Reist, Schenectady, N. Y. App. filed Feb. 14, 1907. The motor is arranged in an air-tight casing which serves as a diving bell for the motor. Compressed air may be forced into the casing so as to expel the water when the motor is operated.

918,608. MULTIPLE SWITCH STARTER; L. L. Tatum, Norwood, Ohio. App. filed May 20, 1907. A plurality of hand operative switches control a resistance and an arrangement is provided whereby the operator must close each switch in a predetermined time after the preceding switch is closed or all the switches will open.

918,609. MULTIPLE SWITCH STARTER; L. L. Tatum, Norwood, Ohio. App. filed Jan. 11, 1909. A plurality of hand operated switches control the resistance, and a retaining device holds them closed. A plurality of devices, one operated by each switch, control the retaining device to open the switches unless each switch is closed within a predetermined time after the preceding one.

918,617. ELECTRIC CONNECTOR; J. J. Walsh, Yonkers, N. Y. App. filed May 1, 1907. For connecting mains with branch lines, by means of clamps which clamp around the wire and the branch line. Details.

918,618. WIRELESS TELEGRAPH RECEIVER; W. M. Way, Austin, Tex. App. filed March 7, 1908. A cup or holder carries a crystalline detector. The cup is rotatable on a vertical axis and an adjustable screw contacts with the crystal.

918,623. ELECTROLYTE FOR PRIMARY BATTERIES; J. W. Whitcomb, Corunna, Mich. App. filed Nov. 27, 1907. May be used with dry or wet batteries and consists of potassium bichromate with other ingredients.

918,627. BURGLAR ALARM AND SIGNAL SYSTEM; G. M. Willis, Chicago, Ill. App. filed Dec. 11, 1906. Details in the construction of a burglar alarm system using alternating current and alternating-current devices actuated thereby.

918,638. CONTROLLER; T. Von Zweigbergk, Preston, England. App. filed Sept. 14, 1907. For railway service, comprising a reversing barrel and contact fingers with mechanism arranged to hold the barrel in various longitudinal positions with reference to the fingers whereby different motors may be cut out.

918,649. ACID-PROOF TANK FOR THE ELECTROLYTIC REFINING OF METALS; A. G. Betts, Troy, N. Y. App. filed Dec. 6. 1906. A tank in which the walls consist of cement with solidified sulphur in the pores.

918,650. ELECTROLYTIC PROCESS; A. G. Betts, Troy, N. Y. App. filed Dec. 23, 1908. The process of producing oxidizing compounds which consists in electrolyzing a solution of a halogen compound with a suitable anode and a cathode of magnesium.

918,654. LAMP SOCKET; J. R. Byrne, Schenectady, N. Y. App. filed July 5, 1907. Key sockets in which a yoke is insulated from the lamp contact, having a bent end in which a bearing aperture is formed, a spring-pressed plunger therein and a key for actuating the plunger.

918,660. INTERCOMMUNICATING TRUNKING SYSTEM; E. R. Corwin, Chicago, Ill. App. filed May 9, 1908. An intercommunicating system for trunking between magneto exchanges and intercommunicating telephone systems. Makes use of a repeating coil inductively connecting one of the local lines with the trunk lines.

918,681. CIRCUIT-BREAKER; K. Kuhlmann, Berlin-Pankow, Germany. App. filed Aug. 16, 1907. Operates after a predetermined time. A controlling member for the circuit responds with a predetermined time lag to variations of current and is locked by a restraining device controlled by an electromagnet.

918,682. SWITCHBOARD SIGNAL; O. M. Leich, Rochester, N. Y. App. filed July 29, 1907. A combined operator's and signaling key, so arranged that after the signal has been actuated it is restored to its concealed position by a movement of the key.

918,688. CONTROL OF ALTERNATING-CURRENT MOTORS; H. Maxwell, Schenectady, N. Y. App. filed Feb. 14, 1906. In combination with a single-phase source, an induction motor having a three-phase winding, devices with different impedances in series with two phases and means for simultaneously varying the impedance step by step.

918,690. ALTERNATING-CURRENT MOTOR; M. Milch, Schenectady, N. Y. App. filed Dec. 23, 1903. In an alternation motor of the repulsion type having two sets of terminals for forward and reverse rotation respectively with means for disconnecting one set from the source of energy and for connecting the other set in short circuit to provide a brake.

918,697. KNIFE SWITCH HANDLE; C. D. Platt, Bridgeport, Conn. App. filed Dec. 11, 1908. A knife switch handle comprising a grip and wood screw. Details.

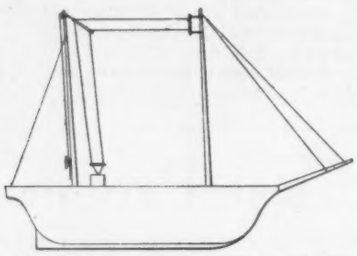
918,732. ELECTRIC HEATING DEVICE; P. C. Chase, Upland, Cal. App. filed July 23, 1908. A portable electric water heater which

may be immersed in a vessel containing water consisting of a plurality of coil-carrying plates. Details.

918,747. ELECTRICALLY OPERATED STOVE; H. Hertzberg and M. J. Wohl, New York, N. Y. App. filed Aug. 1, 1907. An electrically operated stove having a plurality of heating coils with different electrical resistances confined between flat heat-absorbing members.

918,748. ELECTRICALLY HEATED TOOL; H. Hertzberg and M. J. Wohl, New York, N. Y. App. filed Nov. 14, 1907. An electrical resistance, a clamping member provided with a projection and a wedge co-operating with the clamping member, and arranged in the heating chamber so as to produce ventilating spaces.

918,761. TROLLEY WIRE SUSPENDER; J. Mayer, Rutherford, N. J. App. filed Dec. 21, 1907. A hanger comprising a flexible resilient bar, clips connecting the wire in the bar along its length, the cross section of the bar decreasing from the center toward each end.



919,115—Antenna for Wireless Telegraph Systems.

918,810. SPRING AND EQUALIZER SYSTEM FOR ELECTRIC LOCOMOTIVES; W. E. Woodard, Schenectady, N. Y. App. filed Sept. 19, 1908. A spring equalizer system for electric locomotives acting both in a horizontal and a vertical plane in which the side pressure is transmitted to the track through two or more wheels.

918,828. SPRING AND EQUALIZER SYSTEM FOR ELECTRIC LOCOMOTIVES; W. Dalton and W. F. Woodard, Schenectady, N. Y. App. filed Sept. 19, 1909. See 918,910.

918,831. SECONDARY BATTERY; E. C. Ekstromer and M. Ekstromer, Boston, Mass. App. filed May 13, 1907. The active element is of high dialytic power, being an albuminoid from which a portion of the nitrogen and hydrogen has been removed.

918,832. STORAGE BATTERY; E. C. and M. Ekstromer, Boston and Quincy, Mass. App. filed Aug. 1, 1907. The base is provided with ribs forming two series of pockets which receive active material from the plates, so as to avoid danger of short circuiting.

918,844. MEANS FOR CONNECTING CIRCUIT WIRES TO ELECTRIC MOTORS; A. L. Goldschmidt, New York, N. Y. App. filed Aug. 30, 1906. Provides a conduit like a gas pipe in which the wires are carried.

918,845. SWITCHBOARD; A. L. Goldschmidt, New York, N. Y. App. filed July 3, 1908. A plurality of tiers of busbars, each tier terminating short of the set beneath, a base with holes opposite the ends of the tiers, fuses in the holes to connect the busbars with the tiers, and conductors connected to the fuses.

918,852. TELEPHONY; R. C. M. Hastings and T. Matheny, Athens, Ohio. App. filed June 15, 1907. A lockout and selective system for party lines in which the selective means are arranged in series on an all-metal circuit, the latter being grounded at central and at the opposite end of the line during the selective operating and unlocking of the receiver hook.

918,854. LEVER-CONTROLLED SWITCH; M. Hoffman, Berlin, Germany. App. filed Feb. 2, 1907. A lever-controlled switch in which the speed of the brush may be regulated and in which a flexible brush is pivotally connected to the lever and its operation controlled by a cam which reduces the speed of the brush when the maximum pressure is produced.

918,861. ELECTRIC MOTOR; L. F. Johnson, Chicago, Ill. App. filed Sept. 22, 1904. The motor has field cores and an armature core in electrical connection with each other. The field winding is grounded on the field magnet and the armature magnet grounded on the armature core.

918,866. ELECTRIC TRANSMISSION OF INTELLIGENCE; I. Kitsee, Philadelphia, Pa. App. filed June 10, 1908. For transmission of alternating or varying currents by means of a line comprising conductively independent conductors arranged in inductive relation, and associated conductor in an inductive relation with the said conductors and an earth connection for the associated conductors.

918,891. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed Nov. 30, 1908. The block of insulating material has a transverse opening for the receipt of a fuse case with flanges on two opposite sides and a vertical web, extending across and below the bottom thereof.

918,905. INSULATOR; B. A. Pond, Boston, Mass. App. filed Sept. 5, 1908. An insulator having in combination a holder, a bushing formed of insulating material in two parts held by the holder, and an element between the abutting surfaces of the parts.

918,921. WELDING APPARATUS; W. Siebenmorgen, Westfield, N. J. App. filed Feb. 23, 1907. An electric welding apparatus having two relatively movable terminals for drawing an arc, a resistance in the circuit, a shunt around the arc, and automatic means for decreasing the resistance as the current in the shunt rises.

918,950. PROCESS OF REDUCING METAL; H. S. Blackmore, Mount Vernon, N. Y. App. filed March 5, 1909. The process of reducing metal which consists in electrolyzing a substance containing metal, oxygen and fluorine, with an anode containing calcium acetylid.

918,955. TELEPHONE SYSTEM; C. F. Bradburn, Ontario, Canada. App. filed Jan. 20, 1908. A bi-circuit system in which communication is established by a selecting apparatus having a primary and secondary mechanism, the selecting circuit normally without current and actuated by current brought into circuit by the movement of the primary mechanism. The latter consists of a dial and pointer with contact studs.

918,969. INSULATING-BUSHING FOR ELECTRICAL SERVICE-BOXES; R. C. Cole, West Hartford, Conn. App. filed Dec. 11, 1908. Fuse boxes in which the insulating bushings are fastened within the apertures in the walls of the boxes.

919,009. ATTACHMENT FOR CURRENT COLLECTOR WHEELS; L. R. Hecker, Philadelphia, Pa. App. filed July 13, 1907. A plug of insulating material provides means for mounting a brush in contact with the trolley wheel from which a wire leads to a third rail.

919,010. GALVANIC CELL; W. L. Heim, Kane, Pa. App. filed Feb. 28, 1908. A dry galvanic cell having one of its electrodes insulated to prevent deterioration by action of the electrolyte, the insulation being removable by an application of heat.

919,022. CARBON CONSUMING GALVANIC CELL; E. W. Jungner, Kneippbaden, Germany. App filed June 27, 1906. An anode of amorphous carbon, a cathode insoluble in the electrolyte and a depolariser of atmospheric air.

919,069. LIGHTNING ARRESTER OR LINE DISCONNECTOR; J. W. Pedigo, Chariton, Iowa. App. filed June 23, 1908. For telephones in which a pair of suitably shaped contact members connect the wires with a lightning arrester. Details.

919,078. MANUFACTURE OF SENSITIVE CELLS; P. Ribbe, Halensee, Near Berlin, Germany. App. filed Jan. 28, 1909. Selenium cells having parallel conductors covered with selenium in the shape of hairlines, by providing a plate of insulating material with parallel hair-like grooves rubbing on graphite powder, depositing electric conductors in the grooves, then covering the face of the plate with a thin layer of selenium.

919,081. AUTOMATIC MAIL SLOT ALARM; L. M. Robinson, Matteawan, N. Y. App. filed Dec. 11, 1909. For mail boxes, to give an alarm when the mail matter is put through the slot by the postman.

919,089. LEVER CHECK FOR ELECTRIC CONTROLLERS; J. Thomas, New York, N. Y. App. filed Jan. 27, 1909. Means for checking the controller lever so as to prevent sudden rotation by means of an arm and pawl, with a slot receiving the pawl on a reverse movement of the spindle.

919,113. TELEPHONE APPARATUS; C. Adams-Randall, New York, N. Y. App. filed July 28, 1906. A telephone transmitter useful for short and long distance work by controlling the current energy at the transmitter and regulating the amount of current carried thereby.

919,115. ANTENNA FOR WIRELESS TELEGRAPH SYSTEMS; C. D. Babcock, New York, N. Y. App. filed Jan. 24, 1906. For use on shipboard. By locating the horizontal portion in a vertical plane there is less swinging than if the spreaders *D* and *H* were horizontal.

919,137. OSCILLOGRAPH; J. T. Dempster, Schenectady, N. Y. App. filed Feb. 14, 1908. For projecting on a screen the curve of the current or voltage. A magnet produces the primary field and the secondary vibratory member produces the secondary field and vibrates about two axes perpendicular to each other.

919,165. ELECTRIC SMELTING FURNACE; H. C. Harrison, Easton, Pa. App. filed May 4, 1908. A furnace of the arc type employing polyphase currents for smelting, with a plurality of arc electrodes in a row.

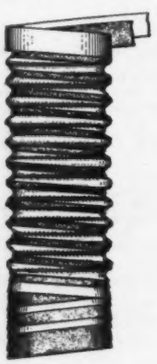
919,171. DEVICE FOR PROTECTING END BEARINGS; W. B. Hodge, Glenside, Pa. App. filed April 8, 1907. For protecting end bearings in measuring instruments of the permanent magnet type. Removes the pivots from engagement with the bearing in shipping by a lever and trigger mechanism.

919,179. ALARM; J. S. Jones, Spokane, Wash. App. filed Oct. 16, 1907. A spring-pressed plug tends to close the circuit and is restrained by a cord which, when it burns, allows the plug to close the circuit and ring a bell.

919,203. DYNAMO VENTILATOR; D. R. McCullough, Pocatello, Idaho. App. filed April 16, 1908. A casing surrounds the dynamo and an exhaust fan driven by the dynamo shaft provides the ventilation.

919,263. TROLLEY HARP; L. J. Tetlow, Holyoke, Mass. App. filed Nov. 14, 1908. A trolley harp in which the contact springs carrying the current are easily removable and replaceable.

919,264. GAS OR VAPOR CIRCUIT BREAKER; P. H. Thomas, Montclair, N. J. App. filed April 25, 1905. Avoids the formation



918,547—Resistance Unit.

918,500—Seal for Arc Light Electrodes.

of an arc by breaking the circuit between surfaces in an exhausted chamber. The circuit closer is mercury and the circuit is broken by breaking the mercury into two parts.

919,267. SYSTEM OF ELECTRICAL DISTRIBUTION; W. A. Turbayne, Lancaster, N. Y. App. filed Oct. 30, 1903. For a system in which the supply voltage varies, particularly in incandescent lighting systems using storage batteries. Switches in a series of end cells.

919,279. AIR DEFLECTOR FOR DYNAMO ELECTRIC MACHINES; F. W. Young, East Orange, N. J. App. filed Dec. 6, 1907. Combination with the motor having radial poles and windings of deflectors near one end of each of the passages between the motor windings which block the passages.

12,943. (REISSUE.) TELEPHONE EXCHANGE SYSTEM; E. Land, Chicago, Ill. App. filed Aug. 9, 1906. Semi-automatic telephone system, using a central operator. Uses no flexible cords, but a trunk selecting switch at the central office.